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Report No. 20 40636

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DOUGLAS AIRCRAFT, DIVISION . LONG BEACH, CALIFORNIA

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#### LANDING LOADS INVESTIGATION INSTRUMENTATION

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REPORT NO. ES 40636 DATE: 10-26-62

CONTRACT NOa(s) 59-6226c

DOUGLAS AIRCRAFT COMPANY, INC. AIRCRAFT DIVISION LONG BEACH, CALIFORNIA



PREPARED BY:

H. D. Meriwether I. E. Harris

APPROVED BY

Swancutt

R. F. Swancutt Chief, Laboratory Test

M. Stone, Chief Aerostructural Mechanics Section

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(ITLE	REPORT	40030

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PAUE 1.001 MODEL A4D-2 REPORT 40636

#### LANDING LOADS INVESTIGATION INSTRUMENTATION

#### INTRODUCTION

Contract NOa(s) 59-6226c was established to measure loads and contact conditions during landings of an A4D-2 airplane. Under the terms of the contract, instrumentation was installed in the airplane and landings were performed at the Naval Air Test Center, Patuxent River, Maryland under specific contact conditions. Upon completion of these landings, the instrumentation was removed from the airplane and shipped to the Douzlas Aircraft Company facility at El Segundo, California for a series of laboratory drop tests with an A4D-2 static test airplane. This report discusses the instrumentation installed in both the flight and drop test airplanes and also the supporting instrumentation used during the flight and drop tests.

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#### DISCUSSION

An experimental flight and airplane drop test program was conducted with consistent instrumentation on a Model A<sup>4</sup>D-2 airplane to measure landing loads and contact conditions. The data obtained during these tests were to be combined with a dynamic analysis. The results of that analysis, together with the results of the tests previously conducted by the NASA at their landing loads track, were expected to provide a firm basis for evaluating the adequacy of simulating loads in airplane and jig drop tests as well as determining the extent to which those loads might be calculated by dynamic analysis.

The installation of the instrumentation in the airplane was completed at the Naval Air Test Center, Patuxent River, Maryland. The work was done under the supervision of Douglas Aircraft Company engineering personnel with the assistance of NATC personnel. The Model A4D-2 airplane, BuNo 142089, remained under the custody of NATC during the instrumentation period and the flight test phase. Actual installation of instrumentation in the airplane commenced July 1, 1960, when the airplane was made available for the Landing Loads Investigation. The airplane had been utilized by NATC for Carrier Suitability testing and contained partial instrumentation. Following completion of the flight test phase of the program at NATC, the Landing Loads instrumentation was removed from the airplane during the month of November, 1960. The instrumentation was then shipped to the Douglas Aircraft Company, El Segundo plant for use in the drop test phase of the program.

A left instrumented main landing gear, No. 10, which had been used by the NASA in their forward velocity drop jig, was installed on the Model A4D-2 airplane, EuNo 142089, together with a right instrumented main landing gear, No. 16. In addition, accelerometers were installed at the airplane center of gravity, the nose, the nose gear, the wing tips and on external wing stores to measure response characteristics of the airplane structure to typical applied ground loads. Other instrumentation was used to define the airplane attitudes, motions, and velocities and to define pressures within the landing gear. Calibrations of the instrumented landing gear were conducted prior to the flight tests, after the flight tests and prior to the drop tests, and again after the drop tests were completed. These calibrations are discussed in detail on Page 2.019.

A special instrumentation store, consisting of a modified 300 gallon external fuel tank, was utilized to carry the oscillograph recorders and the associated equipment. This

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#### DISCUSSION (continued)

store was carried on the airplane centerline pylon for all the landing tests and, subsequently, was used with its equipment during the drop test program. Photographs of the airplane with the instrumentation store installed on the centerline pylon and with the external fuel tanks installed on the wing pylons are included on Pages 1.201 and 1.202.

The airplane parameters were recorded on two 36 channel recording oscillographs. The oscillographs were CEC type 5-119P-3 and were installed in the instrumentation store. Photographs of the instrumentation store with the equipment installed are shown on Pages 1.203 through 1.205. Additional equipment installed in the instrumentation store included four strain gage balance panels, one thermocouple control panel, power supply, time standard, and special calibration boxes.

The strain gage balance panels were of Deuglas design, drawing No. X-5501720, and contain a balance circuit, sensitivity circuit and an automatic calibration circuit. All parameters recorded on the oscillograph were controlled through these balance panels except strut positions, strut velocity, wheel position, strain gage veltage menitor, time standard, and thermocouples. The thermocouple control panel was built by Douglas and contains an automatic calibration circuit and a sensitivity circuit. All thermocouples recording temperatures were controlled through this panel.

Strain gage voltage was obtained from batteries. Six volt batteries were connected in series and parallel to provide either 12 or 18 velts to the balance panels depending upon the sensitivity desired. Part of the batteries were replaced after each day's flight test operation to maintain a constant voltage. The voltage input to the balance panel was monitored on an oscillograph channel to assure that the voltage did not drop below an acceptable level.

The time standard utilized for the flight test phase was a 50 cps frequency generator type 2001-2LP. A 50 cycle trace was generated on both oscillographs and was used as a time base and for oscillograph correlation. For the drop test phase, a Hewlett Packard 205 AG oscillagor was used to record 1000 cycles per second simultaneously on all oscillographs.

Special calibration boxes were used for strut positions and strut velocities. Strut position transducer calibration is discussed on Page 2.401. Strut velocity transducer calibration is discussed on Page 2.415.

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#### DISCUSSION (continued)

The galvanometers used for the measurement of the loads and accelerations were selected for a flat frequency response of 135 cps 5 per cent. Galvanometers with a flat frequency response of 60  $\pm 5$  per cent were used for the lower frequency parameters. All galvanometers were checked prior to use and only those with a damping ratio of  $0.64\pm0.1$  of critical were acceptable. The galvanometer response characteristics were measured before the drop test program and again after the drop test program was completed. These results are tabulated on Pages 1.206 through 1.213 and are presented again with the discussions of the individual parameters in the following portions of this report.

Accelerometers were dynamically checked for natural frequency and damping ratio prior to their initial use. Acceptable limits for damping ratio were  $0.70\pm0.1$  of critical. The accelerometers were dynamically checked following the flight test phase and the results are shown on Page 1.214. Static calibrations were performed on the accelerometers prior and subsequent to the flight test phase. Results of the preand post-calibration are also presented on Page 1.214 and an average value was used to compute accelerations.

Temperatures were monitored in the main landing gear lower mass (axle area) and in the nose section to provide a temperature correction to the unheated accelerometer data if necessary. Temperatures remained within acceptable limits and no corrections were necessary.

The combined effect of the galvanometer and accelerometer on the frequency response characteristics of the recorded parameters is shown in the following sections of this report under the individual sections. The frequency response characteristics are tabulated on Page 1.215. The estimated overall recorded parameter accuracies are shown on Page 1.216.

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PAGE: 1.202

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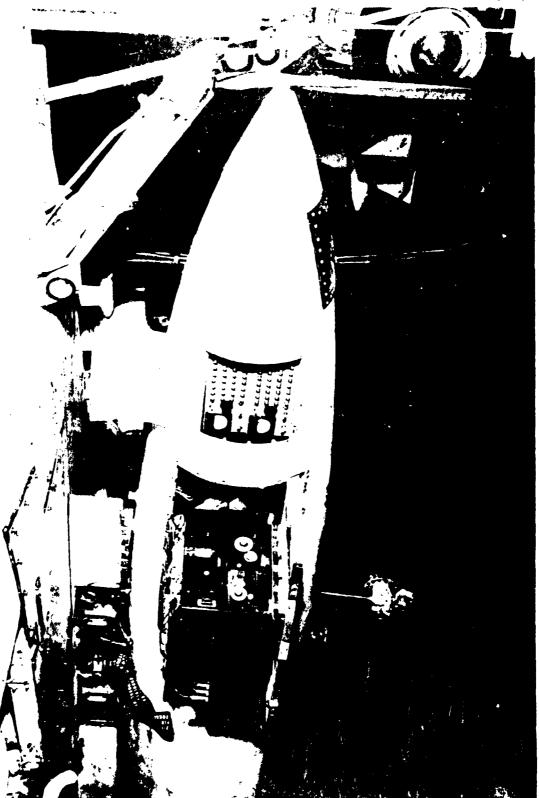
MODEL A4D-2 AIRPLANE BU NO 142089 WITH CENTERLINE INSTRUMENTATION STORE AND TWO 150 GAL. EXTERNAL FUEL TANKS INSTALLED

GE 1.203

MODEL A4D-2

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LANDING LOADS INVESTIGATION



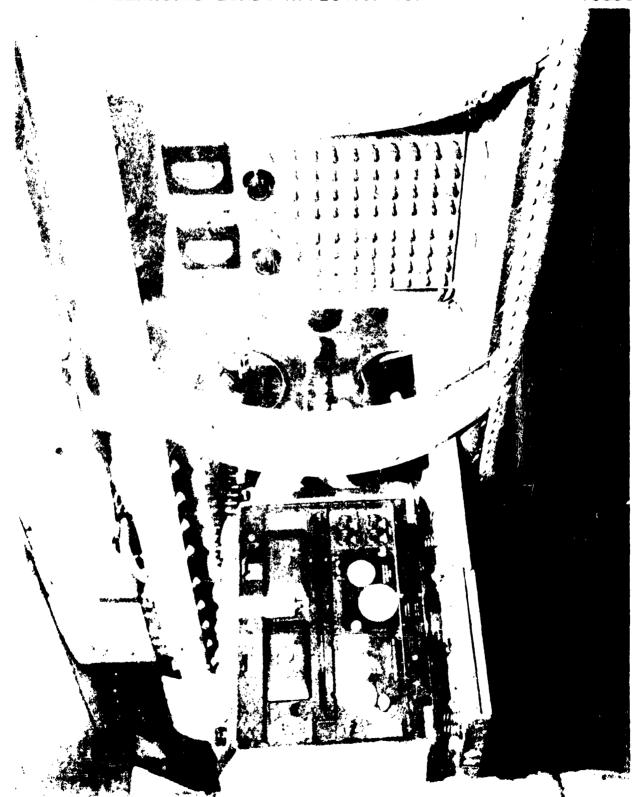
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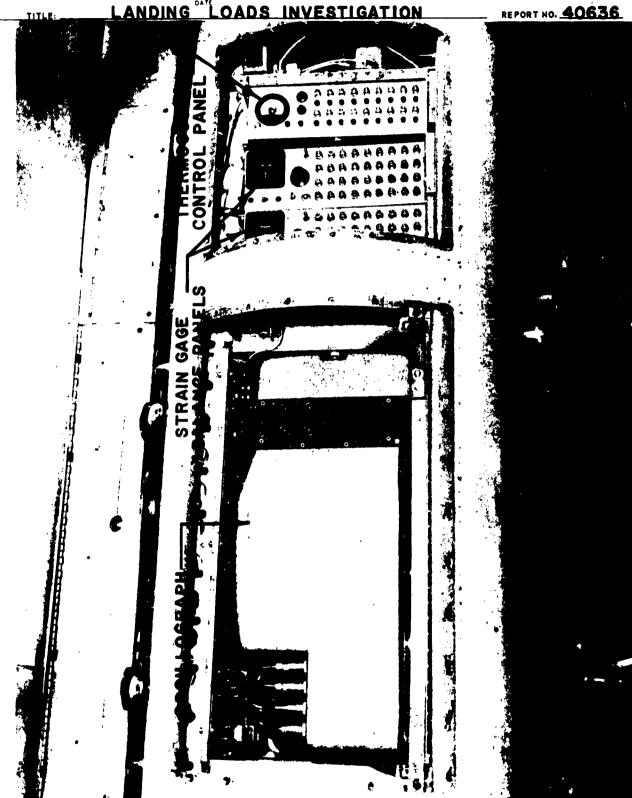
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DOUGLAS AIRCRAFT COMPANY, INC.

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#### GALVANOMETER RESPONSE CHARACTERISTICS

- AMP 1 = Calibration Pip Height from Calibration at Balance Panel
- AMP 2 = Calibration Pip Height from Calibration at Transducer
  - RES = Transducer Resistance at Galvanometer
    - w = Natural Frequency of Galvanometer
- AMP 3 = Desired Amplitude Ratio\* at Galvanometer Natural Frequency
- AMP 4 = Measured Amplitude Ratio\* at Galvanometer Natural Frequency

\*Based on a low frequency amplitude of 2000

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		A <sup>4</sup> D-2 LANDING LOADS INVESTIGA GALVANOMETER RESPONSE	INVESTIGATION BEFORE DROP RESPONSE CHARACTERISTICS	P TEST			
0300	8	TITLE	AMP 1 AMP 2	RES.	8	AMP 3	AMP 4
7	#	LH Air Chamber Pressure	4.852 4.852	352.3	50.4	1187	1196
H	9	LH Strut Position	73.49 73.47	80.15	297.0	1201	1206
н	7	LH Strut Velocity	7.285 -	350.9	201.2	1220	1224
1	∞	IH Vertical Platform 1	4.795 4.805	344.7	217.3	1228	1233
Ħ	6	LH Metering Chamber Pressure	4.768 4.768	351.2	220.0	1245	1248
-	10	LH Axle Vertical Strain Gage V-1	13.84 14.00	352.0	229.5	1253	1259
H	11	LH Gear Lower Mass Vert. Accel.	11.304 11.396	342.4	226.7	1390	1395
ч	12	LH Drag Brace	7.124 7.17	358.8	216.9	1644	1648
н	13	LH Gear Lower Mass Long. Accel.	11.01 11.20	332.9	224.0	1401	1405
<b>~</b> 1	4	LH Axle Drag Strain Gage D-3	7.718 7.706	350.4	226.5	1264	1269
H	16	LH Drag Platform	5.694 5.71	354.4	222.0	1418	1452
н	8	LH Gear Side Bending Moment S-5	11.144 11.158	352.0	229.6	1272	1277
н	23	LH Gear Lower Mass Lateral Accel.	10.694 10.908	332.6	227.1	1409	1413
<b>–</b>	23	Nose Gear Strut Position	72.65 72.63	78.95	312.5	1426	1430
r <del>1</del>	24	Nose Gear Upper Mass Vert. Accel.	11.58 11.584	350.8	228.4	1291	1296
r1	25	Nose Gear Vertical Platform	2.772 2.754	344.6	228.2	1434	1438
	27	C.G. Wormal Acceleration + 10	12.222 12.178	357.7	9.011	1310	1314
н	æ	FRL Pitch Attitude	2.756 -	347.8	51.3	1317	1321

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MODEL 440-2

•	AMP 3 AMP 4	1466	1329	1306	1655	1386	1779
(a)	AMP 3	1463	1325	1301	1651	1381	1776
	: 8 :	106.9	50.7	218.9	228.6	217.0	251.3
P TEST	RES.	364.9	347.8	357.7	403.2	370.5	352.5
TRISTICS	AMP 2		1	11.98	14.828	13.015	
INVESTIGATION BEFORE DROP RESPONSE CHARACTERISTICS	AMP 1	12.354	2.79	11.962 11.98	14.742	12.878	
GALVANOMETER	TILE	29 C.G. Longitudinal Acceleration	A/C Roll Attitude	C.G. Normal Acceleration + 10G	LH Gear Upper Mass Vertical Accel.	LH Gear Upper Mass Long. Accel.	Rebound Chamber Pressure
	8	<b>5</b> 8	8	15	33	大	19
	0300	. H	H	н	н	н	Н

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TITLE Idg. Loads Investigation

MODEL 40636

# A4D-2 LANDING LOADS INVESTIGATION DROP TEST COMPLETED GALVANOMETER RESPONSE CHARACTERISTICS

	<u>ــــــــــــــــــــــــــــــــــــ</u>	GALVANOMETER RESPONSE CHARACTERISTIC		
OSCO	CH	TITLE '	AMP 1	AMP 2
1	14	LH Air Chamber Pressure	5.33	5.28
1	6	LH Strut Position		
1	7	LH Strut Velocity	•	
1	8	LH Vertical Platform 6	7.62	7.57
1	9	LH Metering Chamber Pressure	7.33	7.26
1	10	LH Axle Vertical S. G. 1	13.20	13.05
1	11	LH Lower Mass. Vertical Accelerometer	10.55	10.43
1	12	LH Drag Brace	23.97	23.73
1	13	LH Gear Lower Mass Longitudinal Acc.	10.07	9.94
1	14	LH Axle Drag S. G. D3	5.64	5 <b>.5</b> 6
1	16	LH Drag Platform 6	7.40	7.33
i	20	LH Gear Side Bending Moment	10.22	10.10
1	21	LH Gear Lower Mass. Lateral Accel.	10.73	10.58
1	23	Nose Gear Strut Position		
1	24	Nose Gear Upper Mass. Vertical Accel.	10.93	10.78
1	19	LH Gear Rebound Chamber Pressure	7.42	7.42
1	27	C.G. Normal Accelerometer 10	11.53	11.44
1	28	FRL Pitch Attitude		
1	<b>2</b> 9	CG Longitudinal Accel.	11.54	11.45
1	30	A/C Roll Attitude		
1	31	C.G. Normal Accelerometer 10G	11.50	11.41
1	33	LH Gear Upper Mass Vertical Accel.	14.00	13.92
1	34	LH Upper Mass Longitudinal Accel.	12.21	12.10

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#### GALVANOMETER RESPONSE CHARACTERISTICS

- AMP 1 = Calibration Pip Height from Calibration at Balance Panel
- AMP 2 = Calibration Pip Height from Calibration at Transducer
  - RES = Transducer Resistance at Galvanometer
    - w = Natural Frequency of Galvanometer
- AMP 3 = Desired Amplitude Ratio\* at Galvanemeter Natural Frequency
- AMP 4 = Measured Amplitude Ratio\* at Galvanometer Natural Frequency

\*Based on a low frequency amplitude of 2000

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# A4D-2 LANDING LOADS INVESTIGATION DROP TEST COMPLETED GALVANOMETER RESPONSE CHARACTERISTICS

osco		TITLE	AMP 1	
		RH Air Chamber Pressure	5.32	
2	6	RH Strut Position		
2	7	RH Strut Velocity		
2	8	RH Vertical Platform 2	7.58	7.49
2	9	RH Metering Chamber Pressure	7.30	7.22
5	10	RH Axle Vertical SG 4	12.48	12.34
2	11	RH Gear Lewer Mass Vert. Acc.	11.07	10.94
2	12	RH Drag Platform	7.23	7.16
2	13	RH Axle Drag SG 5	8.94	8.81
2	14	RH Gear Lower Mass Long. Accel.	10.88	10.78
2	15	RH Drag Brace	10.97	10.87
2	16	LH Drag Brace		
2	23	LH Lift Pot Link	7.82	7.72
2	24	RH Lift Pot Link	7.83	7.75
2	<b>2</b> 6	RH Wing Tip Accelerometer	9 <b>.38</b>	9 <b>.30</b>
2	27	LH Wing Tip Accelerometer	9.45	9.40
2	<b>2</b> 9	RH Gear Upper Mass Vert. Accel.	1 <b>3.2</b> 9	13.18
2	31	RH Gear Upper Mass Long. Accel.	10.94	10.84
2	33	RH Axle Side SG 3	8.94	8.81
2	35	RH Gear Lower Mass Lateral Acc.	10.37	10.25

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Tivle Ide. Loads Investigation

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		GALVANOMETER RESIN	RESPONSE CHARACTERISTICS	eristic:	<b>10</b>			
0300	臣	TITLE	AMP. 1	AMP. 2	RES	8	AMP 3	AMP 4
8	7	the state of the s						
N	#	RH Air Chamber Pressure	2.532	2.32	352.2	51.0	9541	1500
a	9	RH Strut Position	70.53	70.63	79.55	256.0	1541	1551
a	7	RH Strut Velocity	43.7	ı	364.2	220.1	H H	905.0
a	80	RH Vertioal Platform	5.786	5.316	7. 445	227.8	1505	1509
N	σι	RH Metering Chamber Pressure	5.536	44.6	350.4	227.0	1514	1518
N	10	RH Axle Vertical Strain Gage	11.02	11.02	348.4	216.0	1483	1492
QI	11	RH Gear Lower Mass Vert. Accel.	10.512	10.926	342.9.	210.5	1618	1622
a	12	RH Drag Platform	5.604	5.558	354.1	227.8	1522	1526
Q	13	RH Axle Drag Strain Cage	10.216	10.248	348.4	224.8	1479	1483
Q	14	RH Gear Lower Mass Long. accel.	11.084	10.954	345.9	217.8	1627	1637
Q	15	RH Drag Brace	11.354	11.366	346.8	230.7	1565	1569
0	16	LH Drag Brace	Note Osc	c No. 1	359.8	209.8	1575	1579
ď	17	RH Wheel Angular Position	N.R.					
(1)	18	1000 Cycle Time Standard	N.R.					
N	19	LH Wheel Angular Position	N.R.					
0	22	Strain Gage Voltage	N.R.					
a	23	IN Lift Pot Link	8.774	8.624	120.4	214.7	1531	1535

FORM 28-3 1 ( 4-51) E 8 .1719

PREPARED By H. D. Meriwether
TITLE Ldg. Loads Investigation

MODEL 40636

FORM LB25 5-14

PREPARED BY: I.R. Happie DOUGLAS AIRCRAFT COMPANY, INC.

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TITLE: Landing Loads Investigation

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AAP 3 BUNG 142089 LANDING LOADS PRUCERNA ACCELEPOMETER INFORMATION

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GENERAL NOTES

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PREPARED BY Harris, Moriwether
TITLE Ldg. Loads Investigation

Nopel 440-2 REPORT 40636

#### FREQUENCY RESPONSE CHARACTERISTICS OF RECORDED PARAMETERS

	PLAT	RESPONSE-CPS
PARAMETER	±2%	±5%
R.H. Gear Vertical Load	115	135
R.H. Gear Drag Load	55 95 50 50 65 65	95
R.H. Gear Side Bending Moment	90	95 180
L.H. Gear Vertical Load	65	195
L.H. Gear Drag Load	50	100
L.H. Gear Side Bending Moment	65	190
L.H. Gear Lower Mass Vertical Acceleration	60	180
L.H. Gear Lower Mass Drag Acceleration	135	150
L.H. Gear Lower Mass Lateral Acceleration	155	175
R.H. Gear Lower Mass Vertical Acceleration	110	130
R.H. Gear Lower Mass Drag Acceleration	135 155 110 45	75 60
R.H. Gear Lower Mass Lateral Acceleration	40	60
R.H. Gear Upper Mass Vertical Acceleration	50	85
R.H. Gear Upper Mass Longitudinal Acceleration	105	130
R.H. Gear Upper Mass Vertical Acceleration R.H. Gear Upper Mass Longitudinal Acceleration L.H. Gear Upper Mass Vertical Acceleration L.H. Gear Upper Mass Longitudinal Acceleration	50	55
L.H. Gear Upper Mass Longitudinal Acceleration	60	90
R.H. Gear Strut Position	65	מנו
L.H. Gear Strut Position	55 55 50 70	90
R.H. Gear Strut Velocity L.H. Gear Strut Velocity R.H. Gear Metering Chamber Pressure L.H. Gear Metering Chamber Pressure	45	70
L.H. Gear Strut Velocity	50	90
R.H. Gear Metering Chamber Pressure	70	180
L.H. Gear Metering Chamber Pressure	60	188
L.H. Gear Strut Rebound Chamber Pressure	55	185
R.H. Gear Strut Air Pressure L.H. Gear Strut Air Pressure R.H. Gear Drag Brace Load L.H. Gear Drag Brace Load	55 15 15 60	40
L.H. Gear Strut Air Pressure	15	40
R.H. Gear Drag Brace Load	60	100
L.H. Gear Drag Brace Load	50	80
Nose Gear Strut Position	80	135
Nese Gear Upper Mass Vertical Acceleration	120	145
C.G. Normal Acceleration (Low Range)	25 40	40
C.G. Normal Acceleration (High Range)	40	22
U.U. Longitudinal Acceleration	20	35
Alforeit riton Attitude .	30	32
C.G. Longitudinal Acceleration Aircraft Pitch Attitude Aircraft Roll Attitude R.H. Wing Tip Vertical Acceleration	20 65 50	55 35 <b>35</b> 35 160
n.n. wing Tip vertical Acceleration	20	120
L.H. Wing Tip Vertical Acceleration	20	80
R.H. Wing Lift Link Load	22	170
L.H. Wing Lift Link Lead	125	145

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PREPARED BY Harris, Mariwether
TITLE Idg. Loads Investigation

PAGE 1.216
MODEL A4D-2
REPORT 40636

# ESTINATED OVERALL RECORDED PARAMETER ACCURACY

PARAMETER	ACCURACY ± %
R.H. Gear Vertical Load	3
R.H. Gear Drag Load	ž
L.H. Gear Vertical Load	ž
L.H. Gear Drag Load	ž
L.H. Gear Lower Mass Vertical Acceleration	Ž
L.H. Gear Lower Mass Drag Acceleration	2
L.H. Gear Lower Mass Lateral Acceleration	2
R.H. Gear Lower Mass Vertical Acceleration	2
R.H. Gear Lower Mass Drag Acceleration	2
R.H. Gear Lower Mass Lateral Acceleration	2
R.H. Gear Upper Mass Vertical Acceleration	2
R.H. Gear Upper Mass Longitudinal Acceleration	2
L.H. Gear Upper Mass Vertical Acceleration	2
L.H. Gear Upper Mass Longitudinal Acceleration	2
R.H. Gear Strut Position	3
L.H. Gear Strut Position	3
R H. Gear Strut Velocity	4
L.H. Gear Strut Velocity	4
R.H. Gear Metering Chamber Pressure	3
L.H. Gear Metering Chamber Pressure	3
L.H. Gear Shock Strut Rebound Chamber Pressure	2
R.H. Gear Strut Air Pressure	Ž
L.H. Gear Strut Air Pressure	Ş
R.H. Gear Drag Brace Load	2
L.H. Gear Drag Brace Load	2
Nose Gear Strut Position	3
Nose Gear Upper Mass Vertical Acceleration	2
C.G. Normal Acceleration (Low Range)	2
C.G. Normal Acceleration (High Range)	2
C.G. Longitudinal Acceleration Aircraft Pitch Attitude	2
Aircraft Roll Attitude	3
· · · · · · · · · · · · · · · · · · ·	Ž
R.H. Wing Tip Vertical Acceleration L.H. Wing Tip Vertical Acceleration	6
R.H. Gear Reaction Platform Vertical Load	۾ 2
	Ř.
R.H. Gear Reaction Platform Drag Lead	õ
L.H. Gear Reaction Platform Vertical Load L.H. Gear Reaction Platform Drag Load	<b>ຠ</b> ຠຠຠ໙ຆຆຆຆຆຆຆຆຆ <b>ຑຑຠ</b> ຺ຘຘຑຓຑຑຑຑຑຆຆຆຑຑຑຆຆຆຑຑຑຆຆ
Nose Gear Reaction Platform Vertical Load	õ
R.H. Wing Lift Link Load	5
L.H. Wing Lift Link Load	2
Timing Clock	0.1
TTMTIR OTACK	V.1

FORM 25 - 3	1
( i= 5, 1)	

PREPARED BY Meriwether, Harris
TITLE Ldg. Loads Investigation

PAGE 2.001

MODEL A4D-2

REPORT 40636

#### MAIN LANDING GEAR

#### Landing Gear Loads

The main landing gears, left and right, were instrumented with strain gages to measure vertical, drag, and side loads perpendicular and parallel to the strut centerline at the axle. Pages 2.002 through 2.018 discuss the individual main gear load parameters and Pages 2.019 through 2.032 discuss the calibration of the strain gages.

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42

#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED By H. D. Meriwether
Tivle Ldg. Loads Investigation

PAGE 2.002 MODEL A4D-2 REMORT 40636

#### DESCRIPTION:

Right hand main gear vertical strain gage channel. This transducer measures vertical loads felt at the base of the piston.

#### CONSTANT:

See section on Gear Calibration. (Page 2.020)

#### CHARACTERISTICS:

#### TRANSDUCER

Type - ABF 13 Strain Gage

#### GALVANOMETER

Type - 7-342

Serial No. - 4981

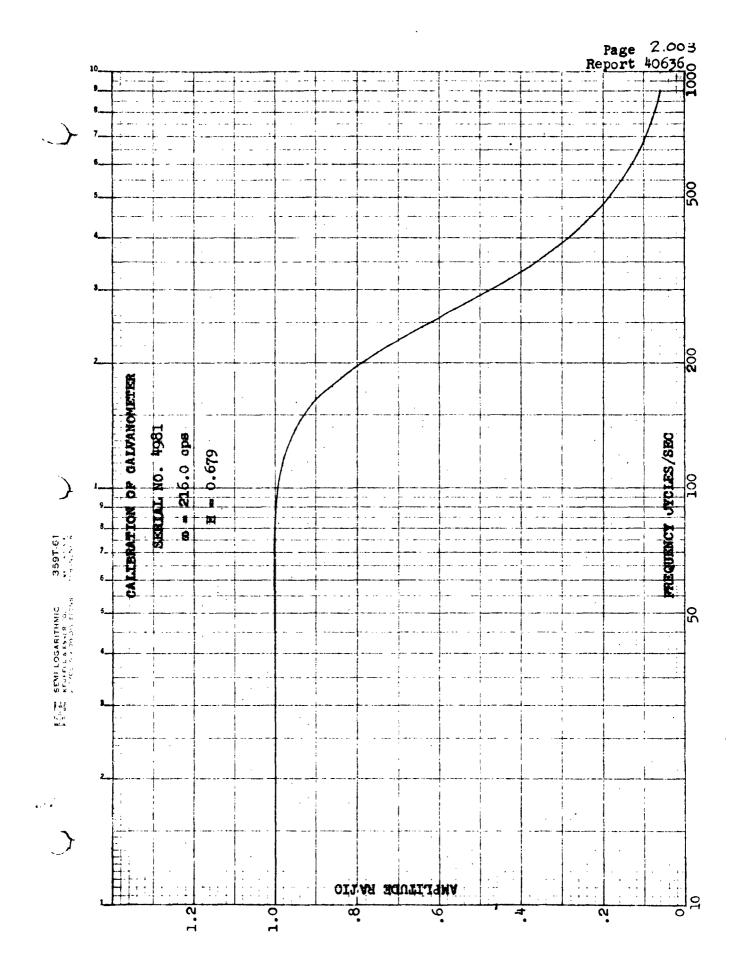
Resistance - 348.4 Ohms

Natural Frequency - 216.0 cps

**Damping** - 0.679

#### RECORDED:

Oscillograph Channel 2-10 for Drop Test 2-16 for Flight Test



PREPARED BY H. D. Meriwether
Title Ldg. Loads Investigation

PAGE 2.004 Mones A4D-2 Report 40636

RIGHT HAND GEAR NO. 16, VERTICAL CHANNEL 4 R = RED (+ BATTERY)
B = BLACK (- BATTERY)
G = GREEN (GRID 1)
BL= BLUE (GRID 2)
RC= CALIBRATION RESISTANCE 100 K Ohms OR CARRIER AMPLIFIER

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PREPARED BY H. D. Meriwether
TITLE Idg. Loads Investigation

PAGE 2.005 MODEL 440-2 REPORT 40636

#### DESCRIPTION:

Right hand main gear drag strain gage. This transducer measures drag loads felt at the base of the piston.

#### CONSTANT:

See section on Gear Calibration.

#### CHARACTERISTICS:

#### TRANSDUCER

Type - ABF 13 Strain Gages

#### GALVANOMETER

Type - 7-342

Serial No. - 4952

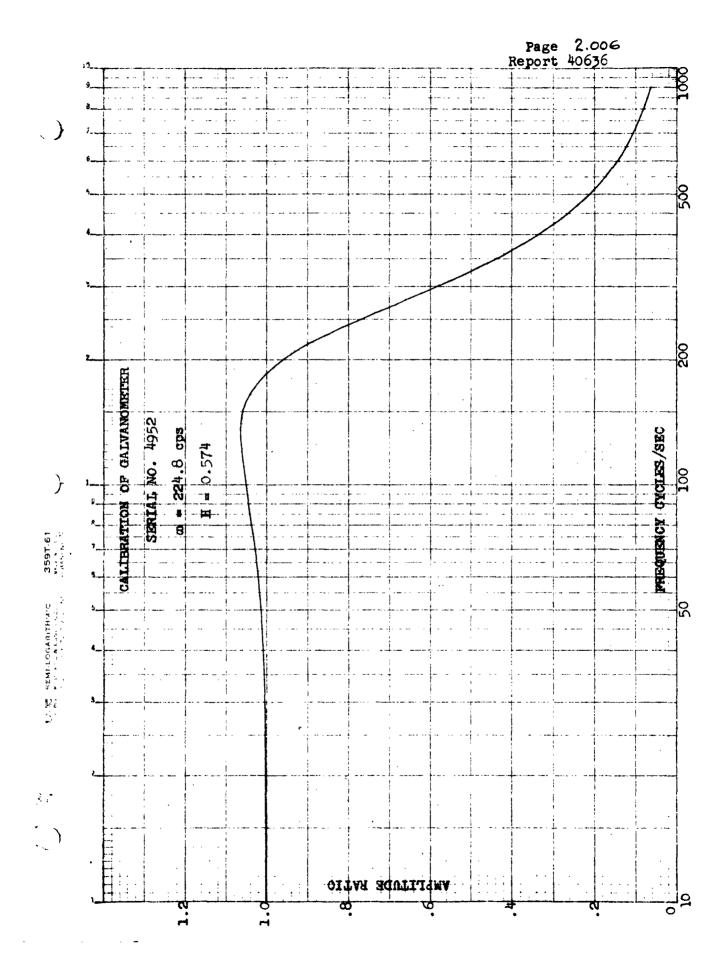
Resistance - 348.4 Ohms

Natural Frequency - 224.8 cps

Damping - 0.574

#### RECORDED:

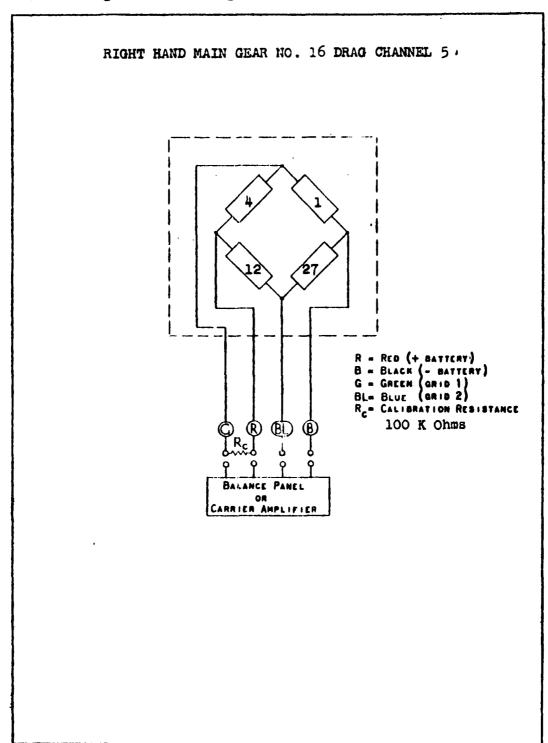
Oscillograph Channel 2-13 for Drop Test 2-15 for Flight Test



Passanso by H. D. Meriwether

Title Landing Loads Investigation

PAGE 2.007 MODEL A4D-2 REPORT 40636



FORM #8 - 8 - 1 - ( 5- 5 1) - 8 - 1740

PREPARED Sy H. D. Meriwether
TITLE Idg. Losds Investigation

PAGE 2.008 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Repaired right hand gear side Channel 3A.

#### CONSTANT:

See section on Gear Calibration.

 $\delta/\Delta = 1.003 \delta/\Delta$ 

#### CHARACTERISTICS:

#### TRANSDUCER

Type - ABF-13 Strain Gages

#### GALVANOMETER

Type - 7-342

Serial No. - 4946

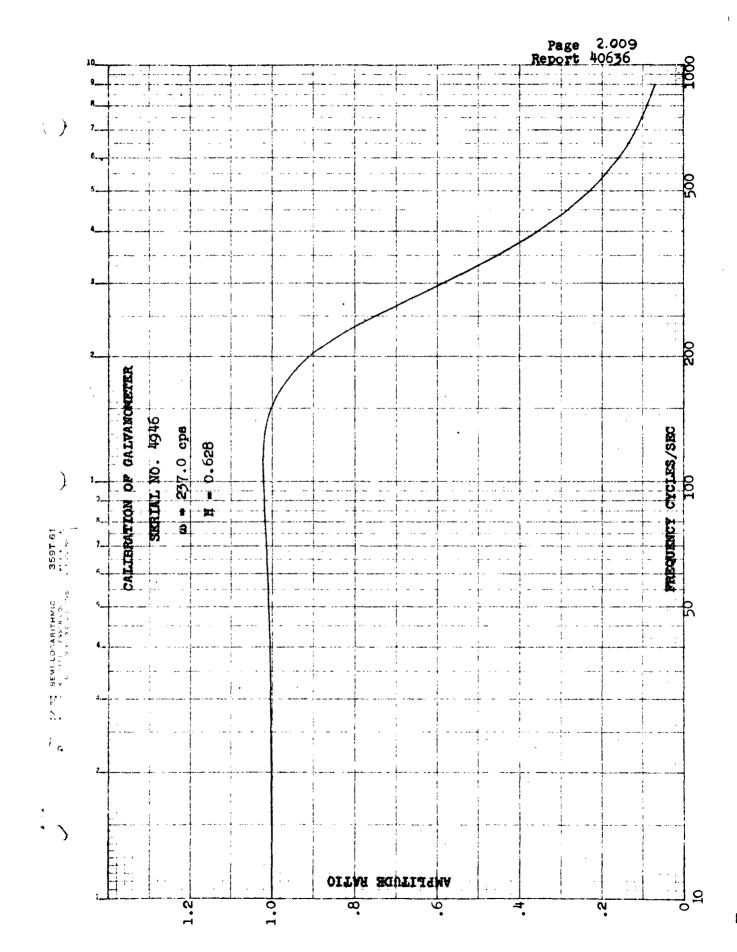
Resistance - 348.6 Ohms

Natural Frequency - 237.0 ops

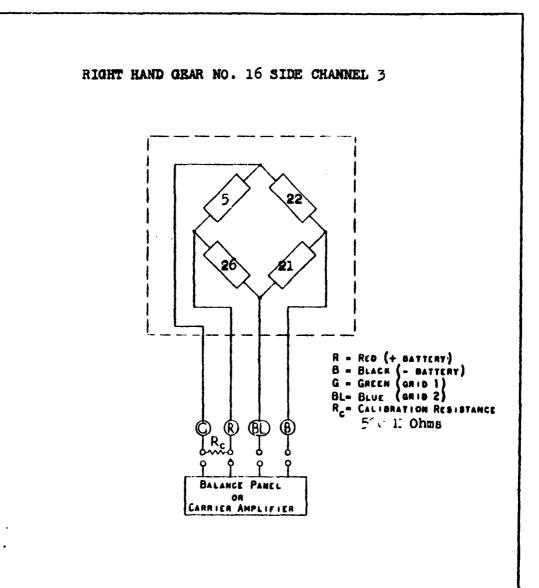
Damping - 0.628

#### RECORDED:

Oscillograph Channel 2-33 for Drop Test 2-15 for Flight Test



PREPARED BY H. D. Meriwether
Title Ldg. Loads Investigation



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FORM 88-8-1

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PREPARED BY H. D. Meriwather
TITLE Ldg. Loads Investigation

PAGE 2.011
MODEL A4D-2
REPORT 40636

#### DESCRIPTION:

· Left hand main gear 10 vertical strain gage bridge 1.

#### CONSTANT:

See calibration of main gears section

 $5/\Delta = .9947 \ 5/\Delta$ 

#### CHARACTERISTICS:

#### TRANSDUCER

Type - ABF-13 strain gage

#### **GALVANOMETER**

Type - 7-342

Serial No. - 4942

Resistance - 352.0 Ohms

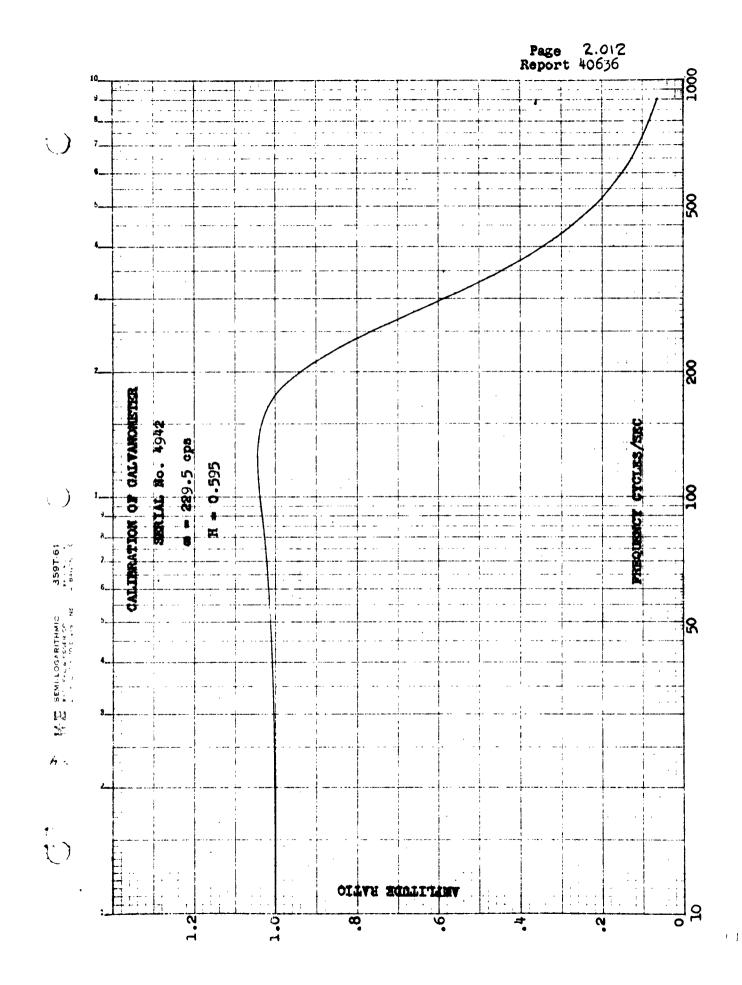
Natural Frequency - 229.5 ops

Damping - 0.595

#### RECORDED:

Oscillograph Channel 1-10 for Drop Test 1-15 for Flight Test

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PREPARED By H. Meriwether
Time Idg. Loads Investigation

PAGE 2.013 MODEL A4D-2 REPORT 40636

# LEFT HAND MAIN GEAR VERTICAL STRAIN GAGE CHANNEL 1 R = RED (+ BATTERY) B = BLACK (- BATTERY) G - GREEN (GRID 1) BL= BLUE (GRID 2) R<sub>G</sub>= CALIBRATION RESISTANCE 100 K Ohms BALANCE PANEL OR CARRIER AMPLIFIER

FORM 88-8-1

PREPARED BY H. D. Meriwether
TITLE Ldg. Loads Investigation

PAGE 2,014 MODEL 44D-2 REPORT 40636

#### DESCRIPTION:

Left hand main gear 10 drag strain gage bridge 3. This transducer measures drag loads felt at the base of the piston.

#### CONSTANT:

See section on main gear calibration.

 $\delta/\Delta^{\dagger} = 1.010 \delta/\Delta$ 

# CHARACTERISTICS:

# TRANSDUCER

Type - ABF-13 Strain Gages

# GALVANOMETER

Type - 7-342

**Serial No. - 7379** 

Resistance - 350.4 Ohms

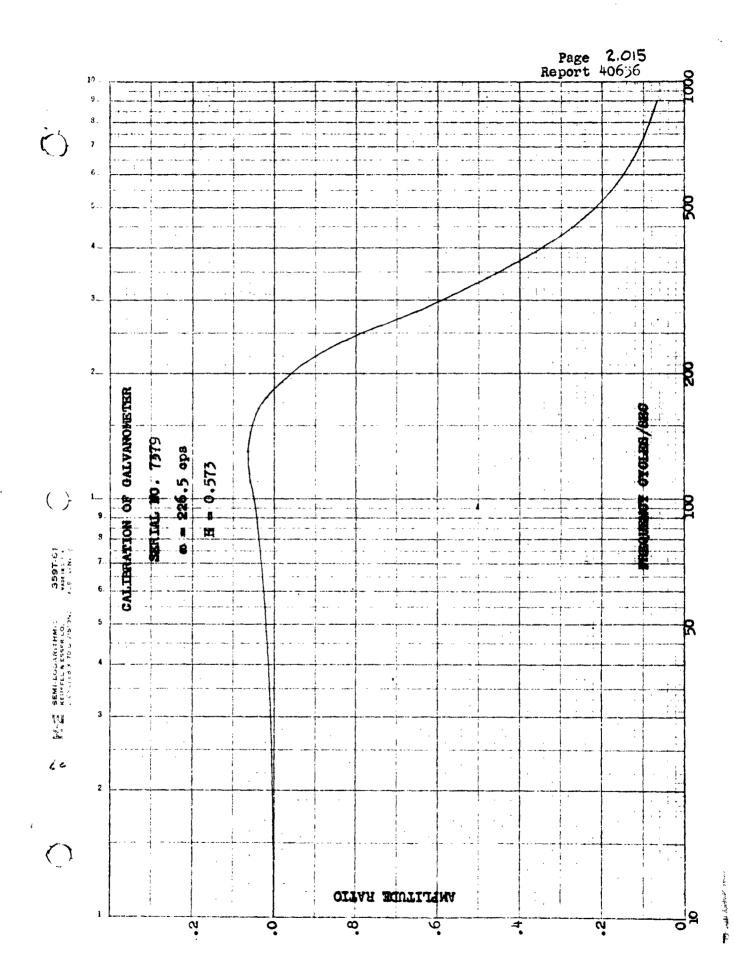
Natural Frequency - 226.5 cps

Damping - 0.573

#### RECORDED:

Oscillograph Channel 1-14 for Drop Test 1-18 for Flight Test

78



PREPARED By H. Meriwether
Tives Ldg. Loads Investigation

PAGE 2.016 Model A4D-2 Report 40636

# LH MAIN GEAR DRAG STRAIN GAGE CHANNEL 3 R = RED (+ BATTERY) B = BLACK (- BATTERY) G - GREEN (GRID 1) BL= BLUE (GRID 2) R<sub>G</sub>= CALIBRATION RESISTANCE Rc= 100 K OHMS BALANCE PANEL OR CARRIER AMPLIFIER

PREPARED BY H. D. Meriwether

TITLE Ldg. Loads Investigation

FORM 85-8 1

MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Left hand main gear side bending moment channel 5. This transducer was intended to measure bending moments induced by side loads.

#### CONSTANT:

See section on calibration.

#### CHARACTERISTICS:

# TRANSDUCER

Type - ABF 13 strain gages

#### GALVANOMETER

Type -7-342

Serial No. - 4662 for Drop Test

Resistance - 352.0 Ohms

Natural Frequency - 229.6 cps

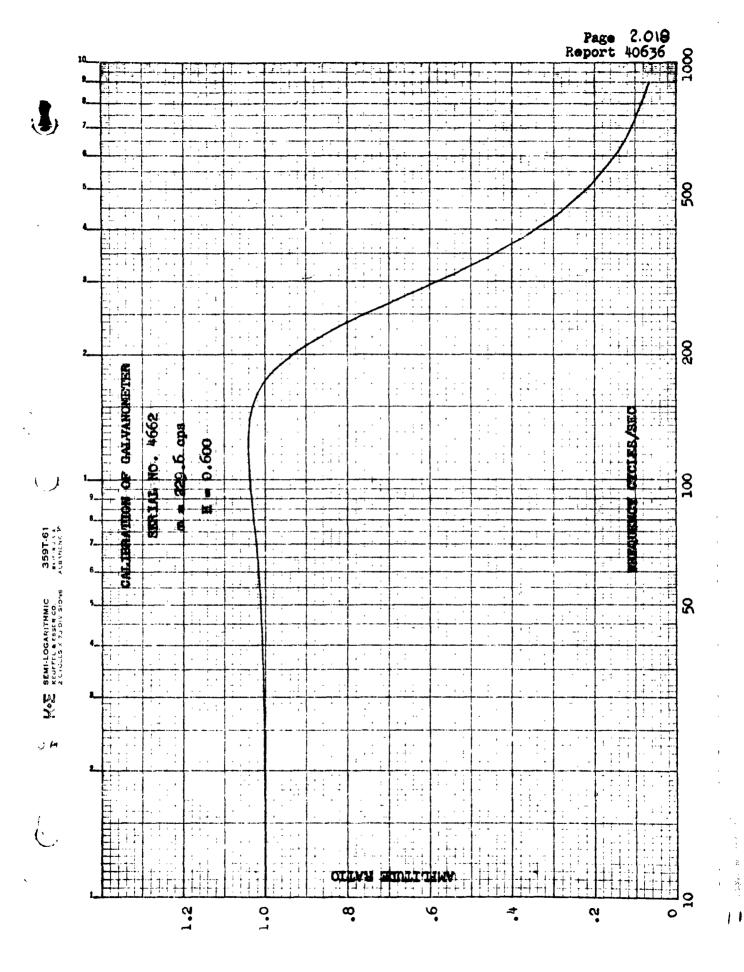
Damping - 0.600

Serial No. - 5085 for Flight Test

#### RECORDED:

Oscillegraph Channel 1-20 for Drop Test 1-12 for Flight Test

4, 8



FORM 25 -5 1

PREPARED BY H. D. Meriwether
TITLE Landing Loads Investigation

PAGE 2.019
MODEL A4D-2
REPORT 40636

#### MAIN LANDING GEAR CALIBRATION:

Although both gears were calibrated statically, the set of equations used to determine loads was obtained from a dynamic calibration.

The static calibrations were initially conducted without the lower mass accelerometer mounts. Subsequent to the test program conducted at NATC, Patuxent River, and the laboratory drop tests, it was determined that the presence of the accelerometer mounts materially affected the stress distribution in the area of the strain gages and, hence, the equation constants.

Both gears were drop tested three times in a column drop jig in the 'as received' condition immediately after the flight test portion of the program, and the set of equations used to determine flight landing loads was obtained from this series. Comparison of the reaction platform load with the strut load obtained using these equations is shown on Pages 2.023, 2.024 and 2.025. Landing gear loads for the airplane drop test part of the program were derived from equations obtained in the same manner. Comparison of loads using these equations is shown on Pages 2.026 through 2.031. Detailed discussion of this procedure follows:

#### VERTICAL LOADS:

The vertical load constants were obtained by fitting coefficients to strain gage readings such that the coefficients would produce the vertical platform readings obtained during drop tests.

Let the desired equation form be set as

V = (A + Bs)x + (C + Ds)y

where V = vertical load

s = strut position

x = vertical gage reading

y = drag gage reading

A, B, C, D = equation coefficients

FORM 85-9-1

PREPARED BY H. D. Meriwether
Title Landing Loads Investigation

PAGE 2.020 MODEL A40-2 REPORT 40636

# VERTICAL LOADS: (Cont'd)

Then the difference, d, between calculated vertical load and measured vertical load can be expressed as

$$d = (A + Ba)x + (C + Da)y - V_{M}$$

V<sub>M</sub> here represents the platform load minus the acceleration-induced load measured by the lower mass vertical accelerometer. The value of "d" was determined every .002 second from the records.

When the summation of d<sup>2</sup> is set to a minimum then the values of the coefficients that produce this condition produce the best fit.

$$d^2 = ((A + Bs)x + (C + Ds)y - V_M)^2$$

The values of A, B, C and D can be obtained by setting the first partial derivatives of the equation with respect to each of the unknowns equal to zero.

$$\frac{\rho((A+Bs)x+(C+Ds)y-V_M)^2}{\rho A}=0$$

etc.

After differentiating and re-arranging:

$$A\Sigma x^2 + BEx^2s + CExy + DExsy = \Sigma V_M x$$
 $A\Sigma x^2s + B\Sigma^2s^2 + CExsy + D\Sigma xs^2y = \Sigma V_M xs$ 
 $A\Sigma xy + B\Sigma xsy + C\Sigma y^2 + D\Sigma sy^2 = \Sigma V_M y$ 
 $A\Sigma xsy + B\Sigma xs^2y + C\Sigma sy^2 + D\Sigma s^2y^2 = \Sigma V_M sy$ 

The solution of these feur equations and four unknowns produced the values of the coefficients used. The formation and manipulation of these equations was handled by an IBM 7090 computer. In these cases where unrealistic (but mathematically cerrect) values for the less important coefficients were obtained, a modification to the basic program was made to have the off-diagonal elements in the matrix solution converge about a diagonal constant which was obtained either during the landing gear static calibration or during the investigation of the effect of the location of the accelerometer mount.

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FORM \$5:5:1

PREPARED By H. D. Meriwether
TITLE Landing Loads Investigation

PAGE 2.021 MODEL A4D-2 REPORT 40636

# VERTICAL LOADS: (contid)

The values obtained by this process are:

# Flight Tests

Left hand gear 10

$$V = (42,500 + 90s)x + (100 + 95s)y$$

Right hand gear 16

$$V = (55495 - 425.4s)x + (450 + 1103.9s)y$$

# Airplane Drop Tests

Left hand gear 10

$$V = (43574.6 - 142.1s)x + (-223.8 + 66.7s)y$$

Right hand gear 16

$$V = (56995 + 337.25)x + (1200-101s)y$$

The reason two sets of equations are necessary is that the accelerometer mount location had been altered between the two series of tests.

#### DRAG LOADS:

The drag load coefficients were obtained from drop tests that were conducted with no wheel spin up and with the strut perpendicular to the deck. A check of drag coefficients during the accelerometer mount investigation showed a negligible change in value of the drag equation coefficients regardless of mount position, hence only the vertical coefficients were determined. The coefficients were then set to produce a minimum residual about zero.

The values obtained by this process are:

#### Flight Tests

Left hand gear 10

$$D = (-670 + 1108)x + (4575 - 58)y$$

Right hand gear 16

$$D = (-2869.9 + 32.8s)x + (8455.8 + 30.8s)y$$

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FORM 25 5 1

PREPARED By H. D. Meriwether
TITLE Landing Loads Investigation

PAGE 2.022 Model A4D-2 REPORT 40636

# DRAG LOADS: (cont'd)

#### Airplane Drop Tests

Left hand gear 10

$$D = (983.3 - 99.1s)x + (4575.0 - 5.0s)y$$

Right hand gear 16

$$D = (4800 - 145.3s)x + (8455.8 + 30.8s)y$$

#### SIDE LOADS:

#### Left Hand Main Gear 10

The piston instrumentation did not include side load measuring gages. An attempt to calibrate for side loads was made by installing bending gages upon the main landing gear barrel. It was found that moments induced by vertical loads far overshadowed any moments induced by side loads, and the attempts at calibration were discontinued.

# Right Hand Main Gear 16

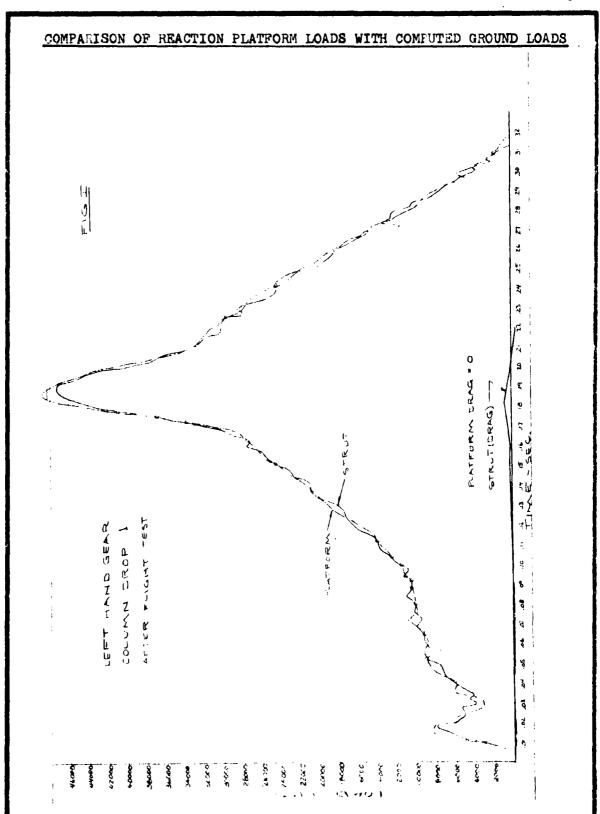
Instrumented main gear No. 16 was used by NATC for catapult tests prior to the Landing Loads Program. During the catapult tests, both primary and secondary side load measuring channels became inoperative. Upon completion of the catapult tests and prior to the landing loads program, unsuccessful attempts were made to salvage these channels. As a last resort, a new strain gage was substituted into the primary side load channel to replace the damaged gage and this channel was recorded during the flight test phase. After completion of the flight test phase, the landing gear was returned to the Contractor's El Segundo Facility where a calibration of this channel was performed. The calibration proved unsatisfactory due to the large amount of interaction with vertical load.

PAGE: 2.023

MODEL A4D-2

TITLE Landing Loads Investigation

REPORT NO. 40636.



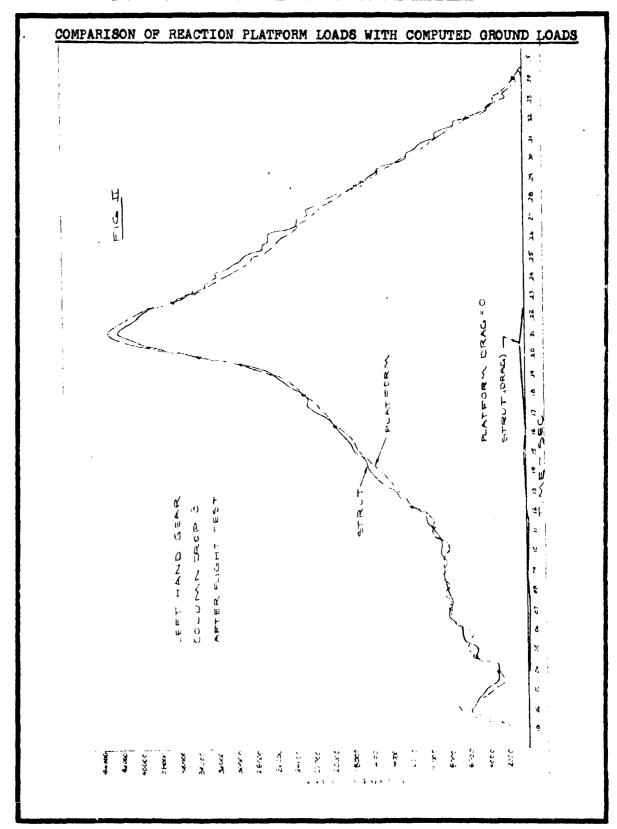
3/1

2.024 A4D-2

TITLE: Landing Loads Investigation

PREPARED BY L. MOBBY

REPORT NO. 40636



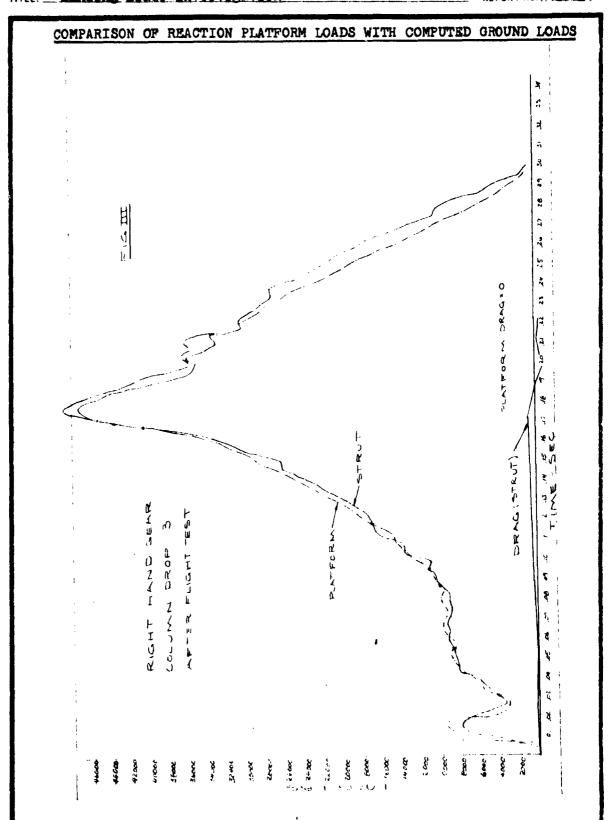
PAGE: 2.02	<u>5</u>	
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PREPARED BY. L. MOSBY

A4D-2

TITLE: Landing Loads Investigation

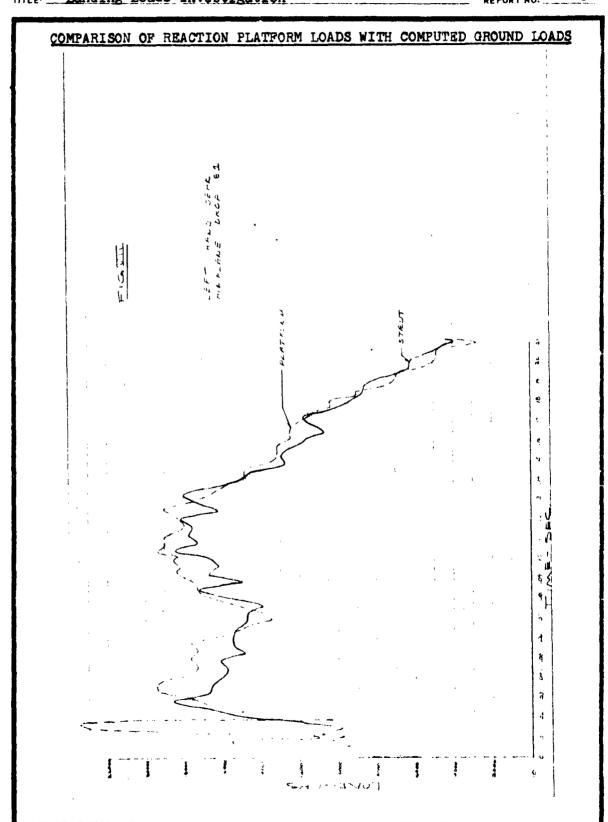
REPORT NO. 40636



AGE: 2.026

TITLE Landing Loads Investigation

ODEL A4D-2 EPORT NO. 40636

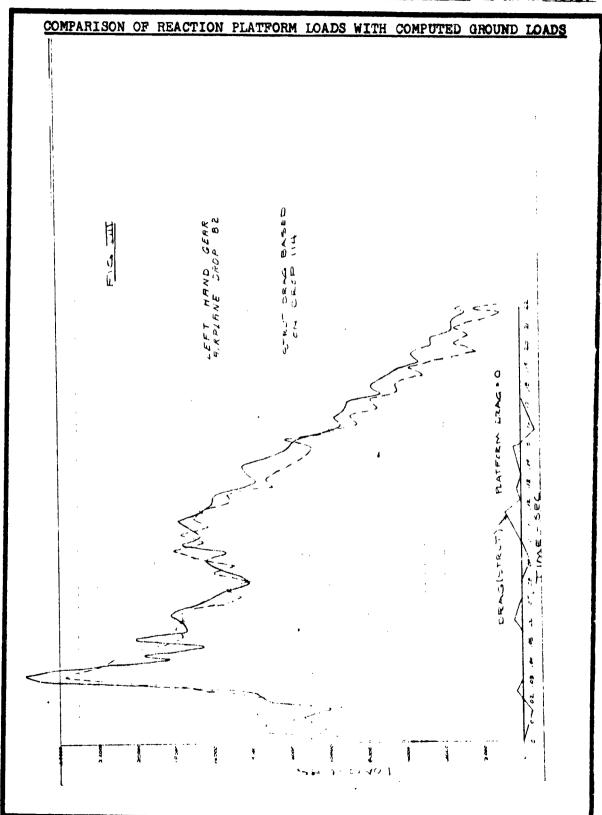


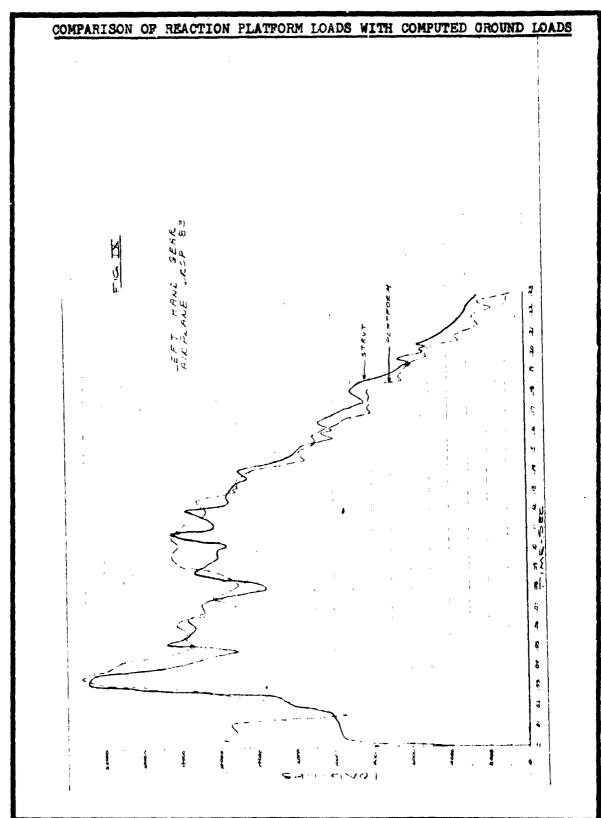
PREPARED BY: L. MOSDY

2.027 MODEL: A4D-2

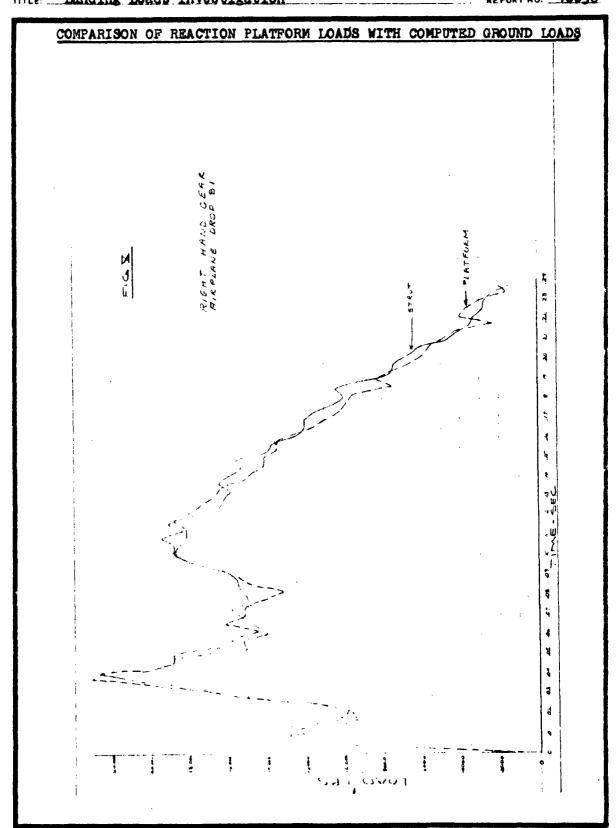
TITLE: Landing Loads Invest

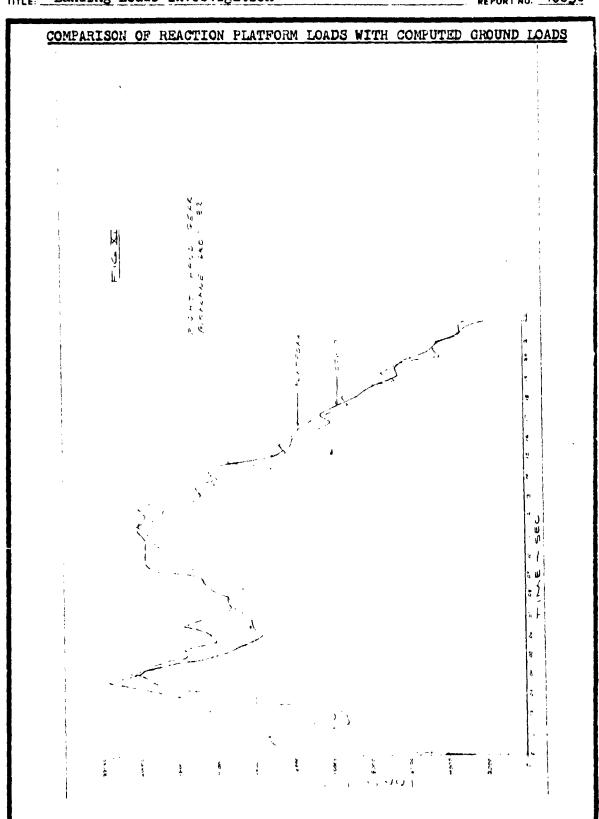
REPORT NO. 40636





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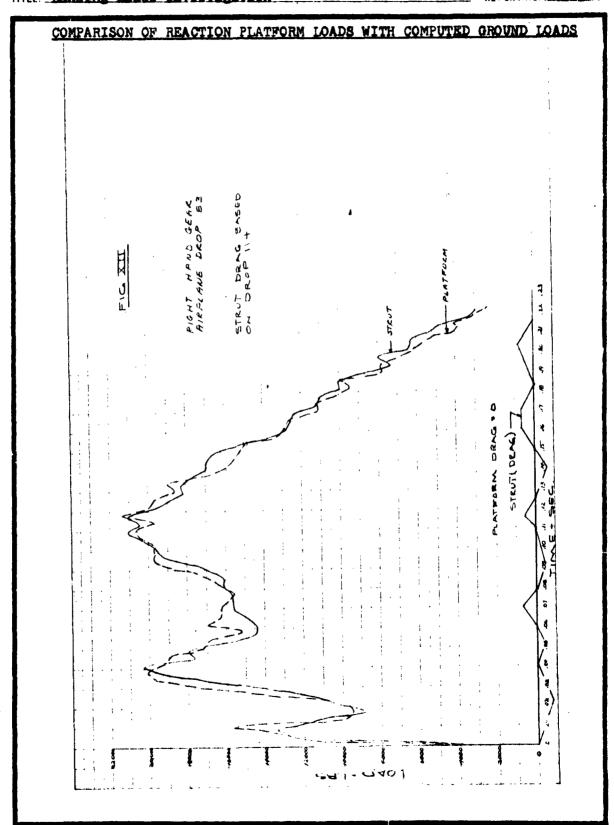




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REPARED BY: 10 1000	DOUGLAS AIRCRAFT	COMPANY, INC.	PAGE: 2,031
CHECKED BY:			MODEL: A4D-2
TITLE: Landing Loads Inve	stigation		REPORT NO. 40636

13 57)



FORM 25-3-1

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## DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY Meriwether, Harris
Title Landing Loads Investigation

PAGE 2.101
MODEL A4D-2
REPORT 40636

# Lower Mass Accelerations .

Accelerometers were installed at the lower end of the main landing gear to measure gear lower mass vertical (normal), drag (longitudinal), and side (lateral) accelerations. A photograph of the typical installation of the mount for the vertical and drag accelerations is shown on Page 2.118. Photographs of the installation for lateral acceleration of the left hand gear appear on Pages 2.113 and 2.114 and for lateral acceleration on the right hand gear appear on Page 2.126.

FORM 35 - 2 - 1 1 (- 51)

PREPARED By H. D. Meriwether TITLE Ldg. Loads Investigation MODEL REPORT

#### DESCRIPTION:

Left hand gear lower wass vertical accelerometer. This transducer measures inertial loads felt at the shock strut axle.

# CONSTANT:

 $Q's = 51.239 \delta/\Delta / 50 K Ohms Resistor Calib.$ 

#### CHARACTERISTICS:

#### TRANSDUCER

Type - Statham A6-100-350

Serial No. - 3726

Natural Frequency - 320 cps (no mount effect)

Damping - 0.66

#### GALVANOMETER

Type - 7-342

Serial No. - 4910

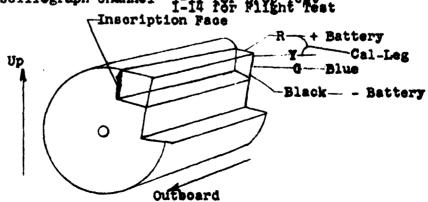
Resistance - 342.4 Ohms

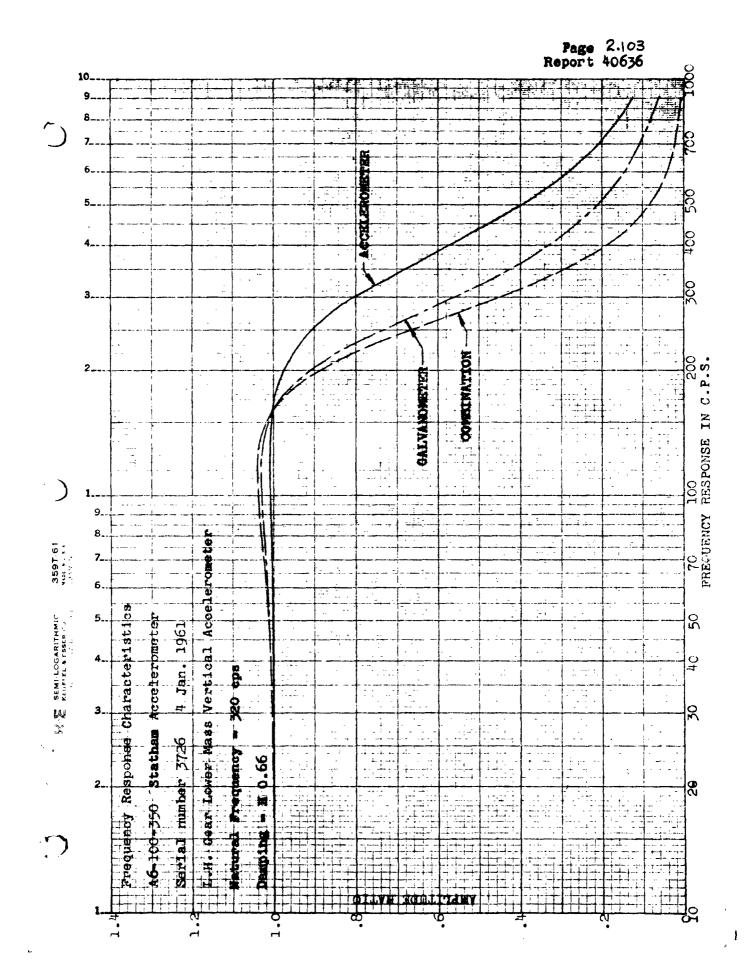
Natural Frequency - 226.7 cps

Damping - 0.612

#### RECORDED:

1-14 for Prognitation Oscillegraph Channel





CHECKED BY:

PREPARED BY: I.E. Harris

TITLE: Ldg. Loads Investigation

A4D-2 MODEL: \_\_

REPORT NO. 40636

Page 2.104 Report 40636

#### TRANSPORTE COLLEGATION

SÉKIAL 1/26 D.K.U. 541070 PLANE MADURY

CALIBRATION AFTER FLIGHT TEST PHASE

THANSDUCER DESCRIPTION ... STAM A 6-100-350 ACCRE. DR 0.06 " NUMINAL MANGE .... +- 100

DIMENSIONS ............ •00 PERCENT UNHALANCE ..... BRIDGE VOLTS....... • • 03 RUN NUMBER.....

VOLTAGE CALIBRATION FACTORS

RMS SLOPE

.:0099 UZ G5 \* /MV/V

1/KMS SLOPE # 33225 -01 MV/V/ 65

KM5 INTERCEPT - 94219 02 65

ANALYST TO JOHN

SHUNT CALIBRATION FACTORS

LLG - CAL-PIP EWUIVALENT GI-CP •51041 02 GU / 50K

al-ir -- 511/2 02 65-11 •52114 9z

U.-CP --01945 02

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SPECIAL CALIBRATION 51.358 TO G2 AT TERM. ENDS

FORM 28-8-1 ( 1-51) E & LITHO

PREPARED BY H. D. Meriwether
TITLE Ldg. Loads Investigation

PAGE 2.105
MODEL A4D-2
REPORT 40636

#### DESCRIPTION:

Left hand main gear lower mass drag accelerometer. This transducer measures inertial loads felt at the shock strut axle centerline.

#### CONSTANT:

Q = 52.351  $\delta/\Delta / 50$  K Ohms Res. Calib.

# CHARACTERISTICS:

### TRANSDUCER

Type - Statham A6-100-350

Serial No. - 3748

Natural Frequency - 265 cps (No mount effect measurements)

Damping - 0.77

# **GALVANOMETER**

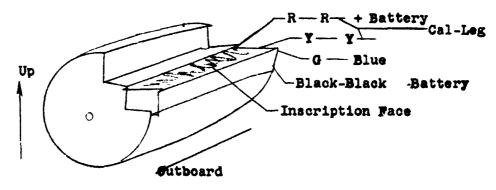
Type - 7-342

Serial No. - 4971

Resistance - 332.9 Ohms

Natural Frequency - 224.0 cps

Damping - 0.573



# RECORDED:

Oscillograph Channel 1-13 for Drop Test 1-17 for Flight Test PORM 89-9-1 ( 3-51) 8 5 5795

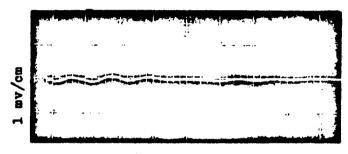
15

DOUGLAS AIRCRAFT COMPANY, INC.

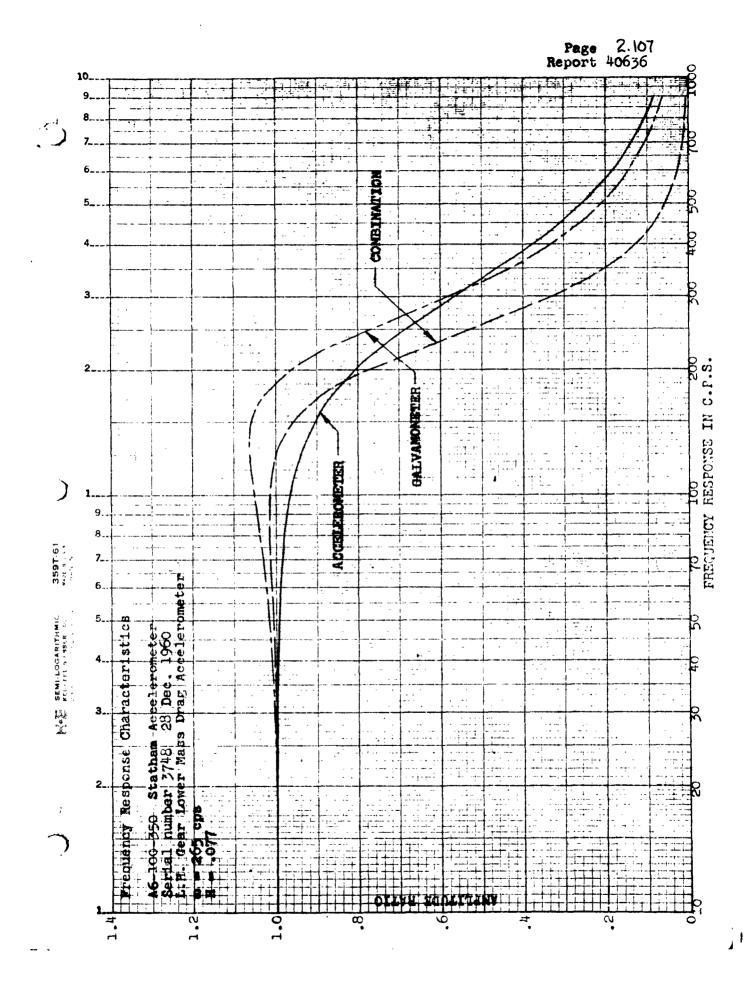
PREPARED BY H. Meriwether
Time Ldg. Loads Investigation

PAGE 2.106"
MODEL A4 D-2
REPORT 40636

MOUNT RESONANCE WITH APPLICATION OF 50 LB STEP FORCE



.001 sec/cm



7

PREPARED BY: I.E. HATTIS

CHECKED BY: \_

TITLE: Ldg. Loads Investigation

MODEL: \_\_A4D+2 REPORT NO. 40636

2.108 Page Report 40636

#### TRANSDUCER CALIBRATION

SERIAL 3748 TAG 33086 D.R.O. 641070 PLANE A4D089

CALIBRATION AFTER FLIGHT TEST PHRSE

PROGRAM E004

TRANSDUCER DESCRIPTION .. STHM A6-100-350 ACCFL. DR 0.77 NOMINAL RANGE.... +-100 .00 PERCENT UNBALANCE..... BRIDGE VOLTS..... CHANNEL NUMBER..... 03

AHALYST ENGR. THE

RUN NUMBER.....

R6= 883.1 A

Wn= 265

CALIBRATION DATE ..... 12/28/6

VOLTAGE CALIBRATION FACTORS

SHUNT CALIBRATION FACTORS

.32075 02 G5 RMS SLOPE /MV/V

CAL-PIP EQUIVALENT LEG .52638 02 GS / 50K G1-CP

.31177 -01 MV/V/ G5 1/RMS SLOPE

-.53802 02 -53844 02 G1-TP G2-TP G2-CP 53844 -.53074 02

RMS INTERCEPT -. 10376 03 GS

LOAD	UP-SCALE DEVIATION	UP-SCALE PERCENT DEVIATION	DOWN-SCAL DEVIATION		AVERAGE DEVIATION
20000 02 .00000 -39 .20000 02 .40000 02 .60000 02	.22721 00 .26972 00 .10434 00 61040 -01 .22593 -02 .23187 00 .29517 00 .33768 00 .33861 00 .21481 00 15846 00	•11 •13 •05 •03 •00 •12 •15 •17 •17 •11 •08	14140 0 98890 -0 56379 -0 20097 0	007 019 024 010 16 007 05	.22721 00 .61830 -01 13473 00 26893 00 10169 00 48781 -01 .76885 -01 .11940 00 .14112 00 .69208 -02 15846 00

SP. CALIB 53.241

30 DEC. 1960

PREPARED By H. D. Meriwether
Title Ldg. Loads Investigation

PAGE 2.109 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Left hand gear lower mass lateral accelerometer. This transducer measures accelerations at aircraft stations X = -38.0, Y = 265.7, Z = -91.4

# CONSTANT:

G's = 49.961 δ/Δ / 50 K Ohms Resis. Calib. (up scale mass outboard)

#### CHARACTERISITICS:

TRANSDUCER DROP TEST	FLIGHT TEST
Type - Statham A6-150-350	A6-50-350
Serial No 3736	3576
Natural Frequency - 289.0	247.0
Damping - 0.744	0.72

# GALVANOMETER

Type - 7-342

Serial No. - 5171

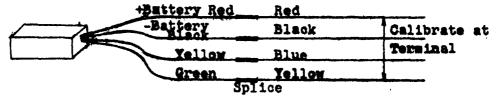
Resistance - 332.6 Ohms

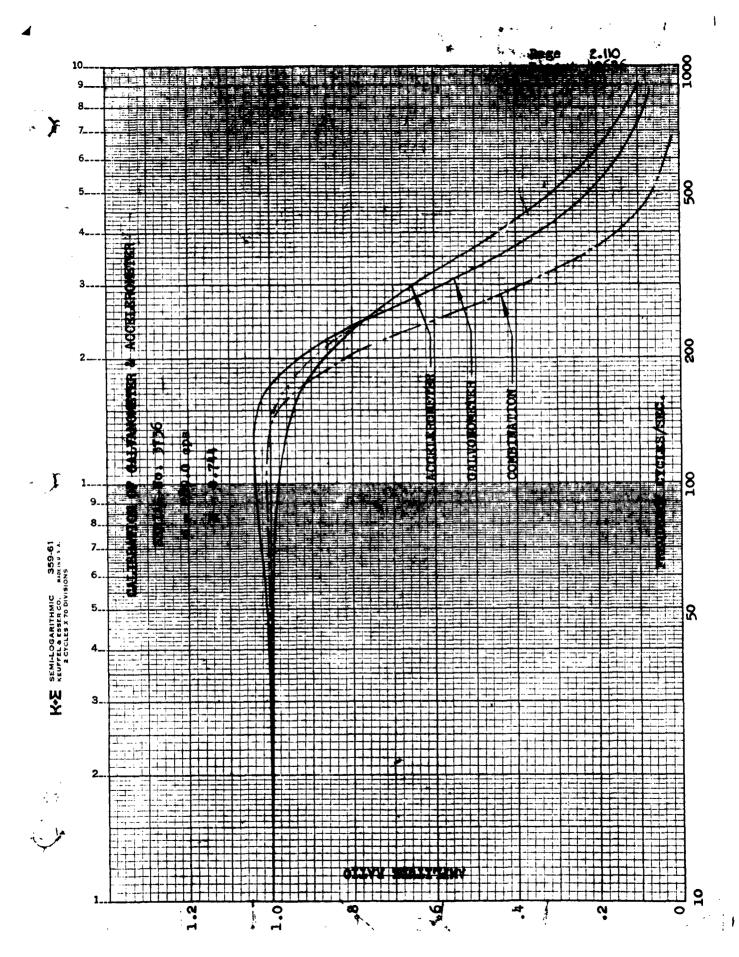
Natural Frequency - 227.1 cps

Damping - 0.606

#### RECORDED:

Oscillograph Channel 1-21 for Drep Test 1-11 for Flight Test





2.111 PAGE: \_\_

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CHECKED BY: \_

PREPARED BY. I.B. Harris

TITLE: Ldg. Loads Investigation

A4D-2 MODEL: \_\_\_

REPORT NO. 40636

PAGE 2.111

#### TRANSDUCER . CALIBRATION

SERIAL 3576 TAG 33083 D.R.O. 641067 PLANE A4D089

# CALIBRATION AFTER FLIGHT TEST PHASE

PROGRAM E004 ANALYST ENGR. Tydings

TRANSDUCER DESCRIPTION .. STHM A6-50-350 ACCL. DRO.72 NOMINAL RANGE .... +-50 .00 PERCENT UNRALANCE ..... 5 BRIDGE VOLTS..... 03 CHANNEL NUMBER..... RUN NUMBER..... CALIBRATION DATE .... 12/23/60

VOLTAGE CALIBRATION FACTORS

SHUNT CALIBRATION FACTORS

RMS SLOPE .1961 02 6S /MV/V .50861 -01 MV/V/ GS 1/RMS SLOPE PMS INTERCEPT -. 51940 02 05

CAL-PIP FOULVALENT LFG G1-CP .32213 02 GS / 50K G1-TP -. 33076 02 G2-IP 02 .33273 -. 32712 02 G2-CP

LOAD		UP-S( DEVIA		UP-SCALE PERCENT DEVIATION	DOWN-SC DEVIAT		DOWN-SCALE PERCENT DEVIATION	AVERA DEVIA	
50000	02	.17359	00	•17	•17359	00	•17	•17359	00
-440000	02	20822	00	• 21	<ul><li>38862</li></ul>	-03	•00	.10430	OΡ
30000	02	.12853	00	•13	-•19360	00	19	32533	-01
-,20000	02	.14237	00	.14	27328	00	27	65455	-01
-,10000	02	41224	-01	04	-•35297	00	<b>35</b>	19709	00
.00000	~39	86972	-01	• 09	32874	00	33	-•12091	00
.10000	0.2	12154	00	•12	30450	00	30	91480	-01
20000	02	14578	00	•15	17636	. 00	18	15291	-01
30000	02	26353	00	• 26	14174	00	-•14	•60897	-01
40000	0.2	.18385	00	• 18	-•239B2	-01	02	• 79933	-01
.50000	0.2	. 20 RCR	0.0	•21	·20808	00	•21	• 20808	00

30 DEC. 1960

.234

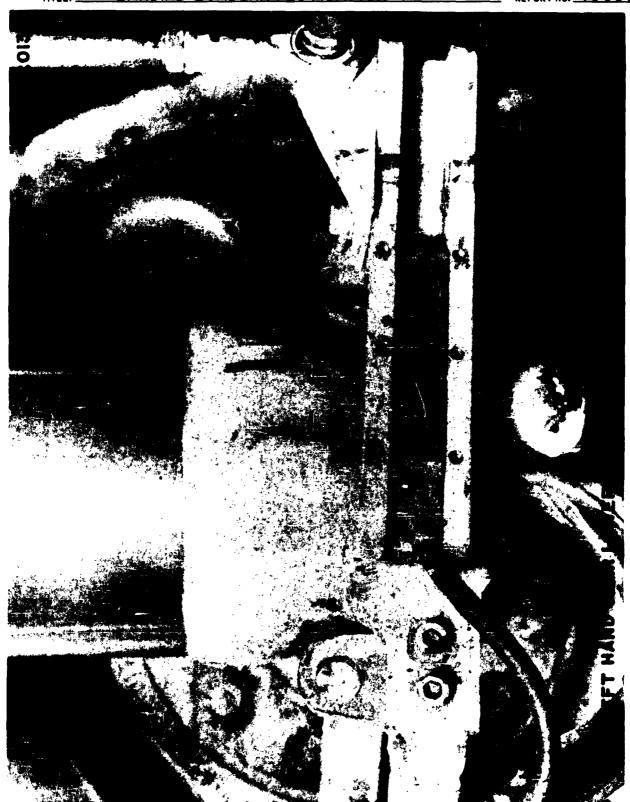
	O APR LANDI	NO LOADS IN	EVESTIGATE	ON		MODEL A40-2 REPORT NO. <b>406</b>
		STATIC	ALIBRATIC	N OF LWR MASS	S LAT ACC	400
				TER PROP 14	حاليظ الخبيب بنطر كي الما	
TEST	RUN	CHANNEL		READ ING	x	γ
16	1	21		202		
16	ì	21	Ţ	20	.02217	•
16	1	21	<b>ં</b>	52	.05765	
16	1	21	0	110	.13193	
16	1.	21	7	163	.12071	
16	1	21	12	220	.24390	
16	1	2.1	15	୭ ୫୦	.31042	
16	1	21	16	723	.35309	18 .
16	1	21	21	178	.41907	
16	1	2.1	24	471	.47783	
15	1	21	27	420	.53215	
16	1	21 •	30	5 36	.59424	
16	1	2.1	35	621	.68847	
16	1	21	40	712	.79601	
16	1	21	45	804	.89135	
15	1	2.1	50	887	.78337	50
16	1	21	<b>3</b> 5	938	1.09534	55
16	1	21	60	10.74	1.19069	63
15	1	21	55	1165	1.20825	65
16	i	21	70	1257	1.39357	
15	1	21	75	1351	1.47773	
16	1	21	53	1447	1.60543	30
16	1	21	85	1540	1.70732	<b>5</b> 5
16	1	21	20	1538	1.61596	
16	1	21	<b>?</b> 5	1714	1.90022	
16	1	21	100	1816		
INTI	RCEPT	SLOPE '	SL	1816 OPL 2 S	SLOPE 3	SCOPE 4
	C.3VA	ELTA Y	MAY . +	NAA	0 MI	TIED X
	.129	49.7	908			
		.327	.793	750	)	.00000
	.104	49.5	100			
		.310	.613	717	,	.98337
	330.	49.9				
		.285	. 545	691	4 F.	.9159£
	• Cu3		0.1			
		.258	.5C4	61	3 2	.01330
	.084	\$0.0				
	• , • ,	***				

.465

-.617 .13173

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PAGE: 2.113 MODEL: A4D-2 REPORT NO. 40636



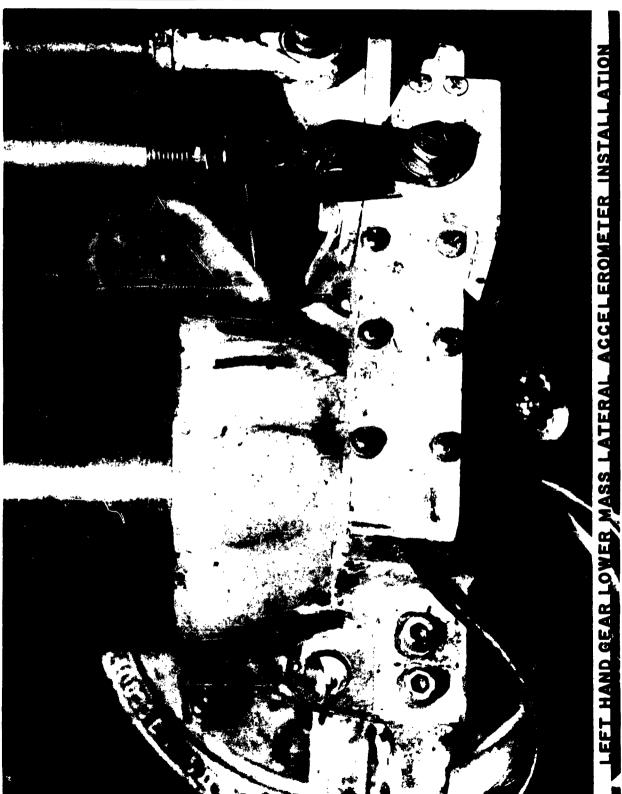
FORM	LB25.	S٠	1 A
(3-5	2)		

PAGE: 2.114

MODEL: A4D-2

L'OADS INVESTIGATION LANDING

REPORT NO. 40636



PREPARED By H. D. Meriwether Time Idg. Loads Investigation

# DESCRIPTION:

Right hand gear lower mass vertical accelerometer. This transducer measures inertial loads felt at the shock strut axle.

#### CONSTANT:

Q's = 53.628  $\delta/\Delta/50K$  Ohms Resistor Calibration

# CHARACTERISTICS:

# TRANSDUCER

Type - Statham A6-100-350

Serial No. - 3762

Natural Frequency - Acc., 288 cps / Mount, 5000 cps

Damping - 0.86

#### GALVANOMETER

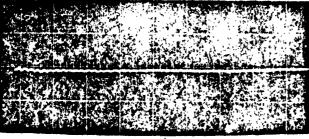
Type - 7-342

Serial No. - 4622

Resistance - 342.9 Ohms

Natural Frequency - 210.5 cps

Damping - 0.578



.001 sec/cm

#### RECORDED:

Oscillograph Channel 2-11 for Drop Test 2-28 for Flight Test

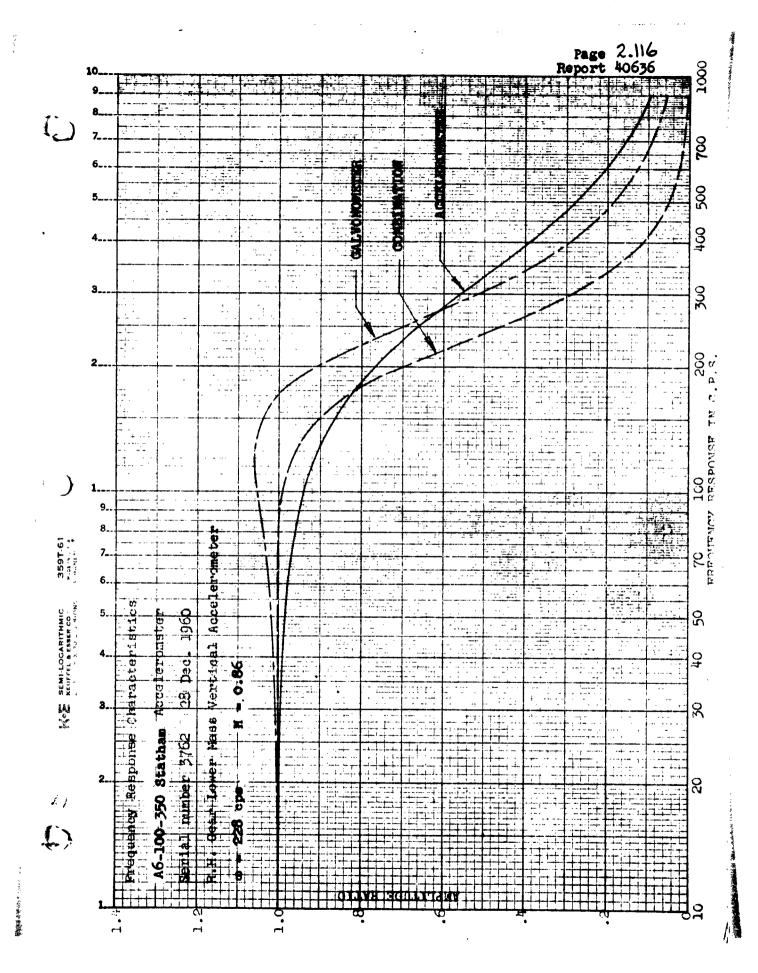
Inscription Face R- +Battery 0-01

0

Black

-Battery

1,7



DOUGLAS AIRCRAFT COMPANY. INC.

Leads Investigation

REPORT NO.

TRANSDUCER CALIBRATION

2.117 Page Report 40636

SERTAL 3762 D.R.O. 641070 PLANE A4DQ89

CALIBRATION AFTER FLIGHT TEST PHASE

TRANSDUCER DESCRIPTION .. STHM A6-100-350 ACCEL. DR 0.86 NOMINAL RANGE .... +-100

PROGRAM EQO4 ANALYST Torginan ENGR.

.00 PERCENT UNBALANCE ..... BRIDGE VOLTS...... 03 CHANNEL NUMBER.....

RE- 543.12

RUN NUMBER..... CALIBRATION DATE .....12/28/60

VOLTAGE CALIBRATION FACTORS

RMS INTERCEPT -. 10337 03 GS

SHUNT CALIBRATION FACTORS

+31340 02 GS - /MV/V RMS SLOPE

LEG CAL-PIP EQUIVALENT G1-CP .53145 02 GS / 50K -.54119 G1-TP 02

1/RMS SLOPE .31908 -01 MV/V/ GS

62-TP 54016 G2-CP -.53663

LOAD		UP-S DEVI	CALE AT ION	UP-SCALE PERCENT DEVIATION	DOWN-SO DEVIA		DOWN-SCALE PERCENT DEVIATION	AVER/ DEVI/	
10000	03	•52561	-01	٠٥3 -	.28047	00	.14	. 16652	00
80000	02	A 34838	00	•17	21105	00	11	.68666	-01
-460000		12621	00	• 06	14314	00	07	84674	-02
40000	02		00	•17	44819	00	22	54521	-01
+420000	02	-26202	00	•13	-•46316	00	23	10057	00
.00000	-39	-422311	-01	01	43670	00	22	22951	00
20000	02	.10775	00	.05	32736	00	16	10980	00
40000	02	-21709	00	•11	19730	00	10	.98982	-02
60000		• • • • • • • • • • • • • • • • • • • •		414	10867	00	05	.58161	-01
.80000				•11	.66948	-03	•00	.11463	QO .
10000	03	• <u>1</u>	00	.06	.11001	00	•06	.11001	Q0

30 DEC. 1960

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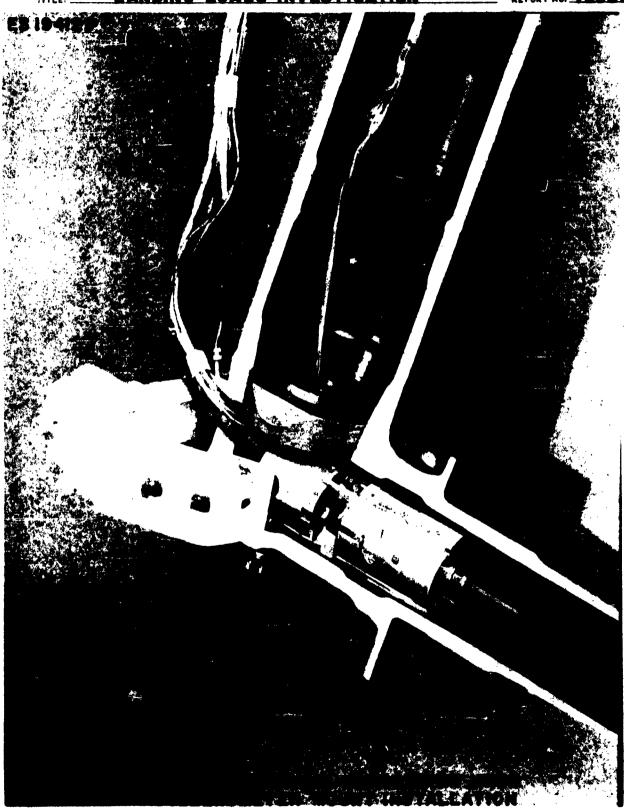
PAGE: 2.118

CHECKED BY:

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<u> Anding l'oads investigation</u>

REPORT NO. 40636



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13-43)

### DOUGLAS AIRCRAFT COMPANY, INC.

Presence by H. D. Meriwether
Time Idg. Icade Investigation

Moost 440-2 Report 40636

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#### DESCRIPTION:

Right hand main gear lower mass drag accelerometer. This transducer measures inertial loads felt at the shock strut axle.

### CONSTANT:

 $G's = 67.203 \delta/\Delta / 50K$  Ohms Resistor Calibration

### CHARACTERISTICS:

## TRANSDUCER

Type - Statham A6-100-350

Serial No. - 3593

Natural Frequency - 340.0 cps

Damping - 0.50

### **GALVANOMETER**

Type - 7-342

Serial No. - 3706

Resistance - 345.9 Ohms

Natural Frequency - 217.8 cps

Damping - 0.611

80

.001 sec/om

Up

W-Y-Black-Blue R-Black -Battery

+ Batter

Inscription Face

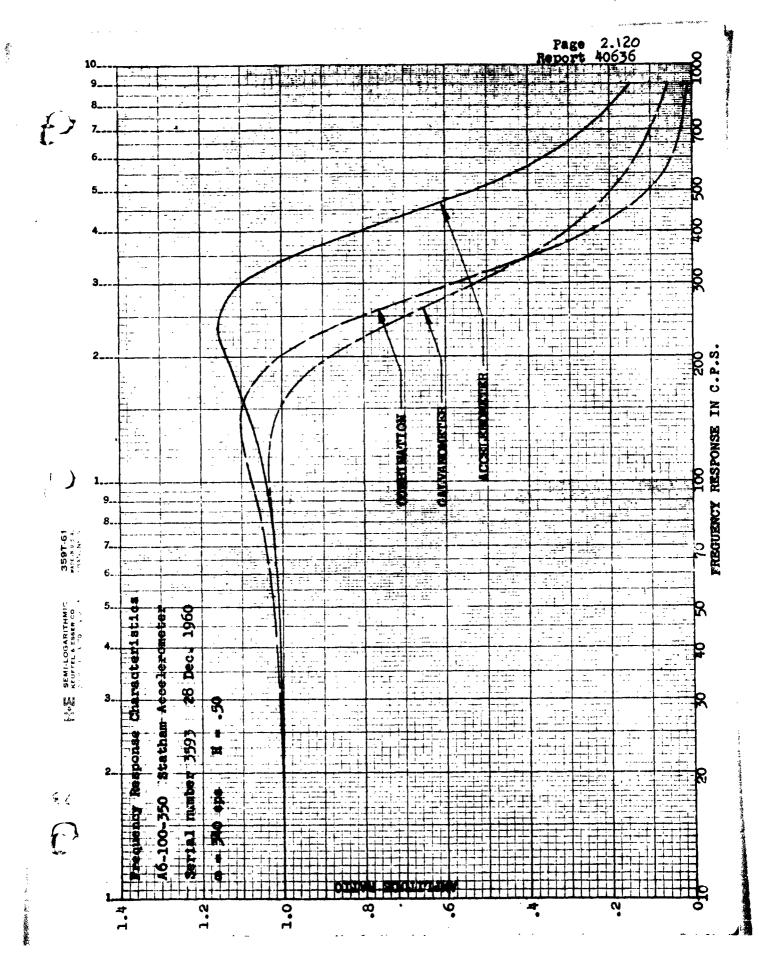
Outboard

RECORDED:

Oscillograph Channel 2-14 for Drop Test 2-29 for Flight Test

27

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PAGE: ...

PREPARED BY: I.K. Harris DATE CHECKED BY: TITLE: Idg. Loads Investigation

REPORT NO. 40636

# TRANSDUCER CALIBRATION

Page 2.121 Report 40636

SERIAL 3593 TAG 32417 D.R.O. 641070 PLANE A4D089

~~/

CALIBRATION AFTER FLIGHT TEST PHASE

PROGRAM E004 ANALYST ENGR. 7:

TRANSDUCER DESCRIPTION .. STHM A6-100-350 ACCEL. DR 0.50 NOMINAL RANGE.... +-100 Wn= 340 DIMENSIONS......GS .00 PERCENT UNRALANCE..... BRIDGE VOLTS...... 5

RG= 846.3 IL

CHANNEL NUMBER..... 03 RUN NUMBER..... CALIBRATION DATE ..... 12/28/60

VOLTAGE CALIBRATION FACTORS

SHUNT CALIBRATION FACTORS

RMS SLOPE -.38908 02 GS /MV/V 1/RMS SLOPE -. 25701 -01 MV/V/ GS RMS INTERCEPT . 10436 03 GS

CAL-PIP EQUIVALENT LEG G1-CP -.67508 02 G5 / 50K G1-TP .66505 02 G2-TP -.67027 02 G2-CP **.68698 02** 

LOAD		DEV I	CALE ATION	UP-SCALE PERCENT DEVIATION	DEVIAT		DOWN-SCALE PERCENT DEVIATION	AVERAGE DEVIATIO	M
10000	03	.12540	00	• 06	~•83470	-01	04	•20967 -01	
80000	02	.44956	00	• 22	-•15617	00	08	<b>•14669 00</b>	į
60000	02	.41863	00	• 21	39598	00	20	•11325 -01	
40000	02	.36681	00	• 18	67756	00	34	15537 00	i
20000	02	.33588	00	•17	62494	00	31	14453 00	,
.00000	-39	.49294	00	• 25	57232	00	29	39690 -01	
• 20000	02	60822	00	• 30	51970	00	26	•44260 -01	
.40000	02	.51463	00	<b>◆26</b>	46708	00	23	.23774 -01	
.60000	02	.48370	00	. • 24	-•28913	00	14	•97281 -01	
.80000	02	.28567	00	• 14	-429918	00	15	67549 -02	
•10000	03	.40894	-07	• 00	<b>♦40894</b> ·	-02	•00	.40894 -02	:

30 DEC. 1960

SP. CALIB 66.400

PREPARED By H. D. Meriwether
Tives Idg. Loads Investigation

MODEL A4D-2 40636

### DESCRIPTION:

Right hand main gear lower mass lateral accelerometer. This transducer measures accelerations at aircraft stations X = 38.0, Y = 265.7, and Z = -91.4.

## CONSTANT:

 $G's = 39.700 \delta/\Delta / 50K$  Ohms Resistor Calibration (up scale, mass inboard)

### CHARACTERISTICS:

## TRANSDUCER

Type - Statham A6-50-350

Serial No. - 3575

Natural Frequency - 294.0 cps, Mount 745.4 cps

Damping - 0.46, Mount 0.060

#### GALVANOMETER

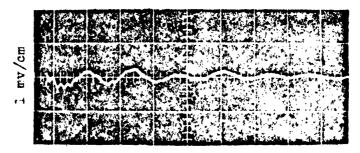
Type - 7-342

Serial No. - 5021

Resistance - 338.6 Ohms

Natural Frequency - 222.6 cps

Damping - 0.586

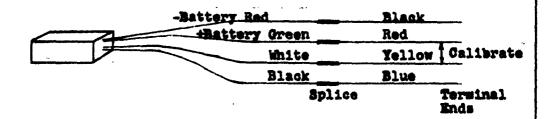


.001 sec/cm

FO	RM :	88.	٠.	1
- (	5- 9	11		

PREPARED By H. Meriwether
Ting Ldg. Loads Investigation

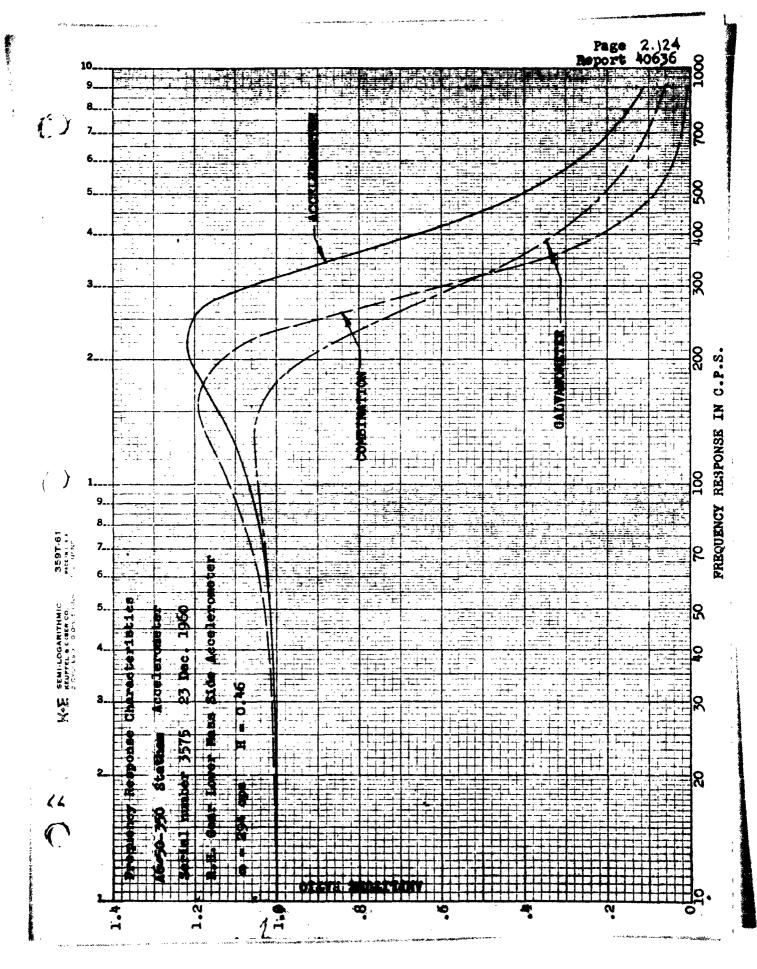
# RIGHT HAND LOWER MASS LATERAL ACCELERATION



Acce, label on top, wire leads aft

# RECORDED:

Oscillograph Channel 2-35 for Drop Test 2-27 for Flight Test



MODEL

TITLE: Idg. Loads Investigation

PREPARED BY: I.E. Harpis

REPORT NO. 40536

Page No. 2.125 Report 40636

#### TRANSDUCER CALIBRATION

wn= 294

LEG

SERIAL 3575 33082 TAG D.R.O. 641067 PLANE A4D089

CALIBRATION AFTER FLIGHT TEST PHASE

PROGRAM E004 ANALYST ENGR. Tyleman ~\?\

/ 50K

TRANSDUCER DESCRIPTION..STHM A6-50-350 ACCL. DRO.46 NOMINAL RANGE..... +-50 DIMENSIONS................GS PERCENT UNBALANCE..... .00 BRIDGE VOLTS..... CHANNEL NUMBER..... 03 RUN NUMBER.... CALIBRATION DATE ..... 12/23/60

VOLTAGE CALIBRATION FACTORS

SHUNT CALIBRATION FACTORS

CAL-PIP EQUIVALENT

RMS SLOPE -.23026 02 GS /MV/V 1/RMS SLOPE -.43430 -01 MV/V/ GS RMS INTERCEPT .52311 02 GS

G1-CP -. 38520 02 GS G1-TP .39336 02 G2-TP -439577 G?-CP .39169

LOAD	UP-SCALE DEVIATION	UP-SCALE PERCENT	DOWN-SCALE DEVIATION	DOWN-SCALE PERCENT	AVERAGE DEVIATION
<b>)</b>		DEVIATION		DEVIATION	•
50000 02	.48725 -01	.05	•16387 00	•16	.10630 00
40000 02	.10475 00	.10	10460 00	<b>10</b>	•77724 -04
30000 02	.13984 00	•14	15324 00	15	67005 -02
20000 02	.11213 00	•11	19142 00	19	-439647 -01
10000 02	•634B3 -01	•06	-,22960 00	23	83060 -01
,00000 -39	·12998 00	•13	28872 00	29	79371 -01
•10000 oz	.18600 00	. •19	13849 00	14	23758 -01
*50000 05	.13735 00	•14	17667 00	18	19655 -01
• 30000 02		•19	13111 00	13	•31137 -01
<b>.</b> 40000 02	• • • • • • • • • • • • • • • • • • • •	•14	64613 -01	06	•40060 -01
•50000 OZ	•54217 -01	.05	•54217 -01	<b>.</b> 05	•54217 -01

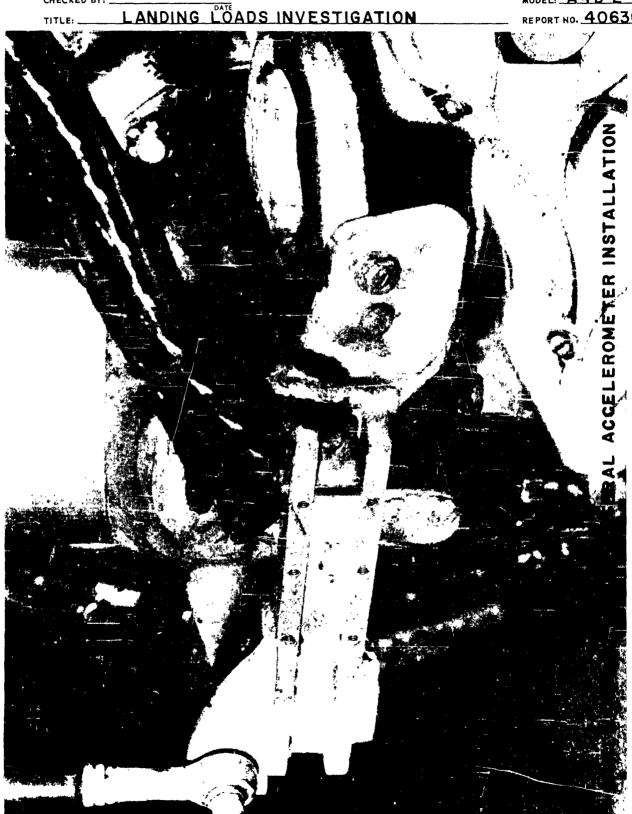
SR CALIE 39,241 30 DEC. 1960

PREPARED BY:

CHECKED BY: \_

PAGE: 2.126 MODEL: A4D-2

REPORT NO. 40636



FORM 25 5 1

#### DOUGLAS AIRCRAFT COMPANY, INC.

DATE	
PREPARED B	. H. Meriwether
TITLE Ld	g. Loads Investigation

PAGE 2.201 MODEL 440-2 REPORT 40636

# Upper Mass Accelerations

Accelerometers were installed on the upper portion of the landing gear barrel to measure vertical and drag accelerations. A photograph of the installation of the accelerometers on the right hand gear is shown on Page 2.206. The installation of the accelerometers on the left hand gear is shown on Page 2.215.

PREPARED By H. D. Meriwether

Title Ldg. Loads Investigation

PAGE 2.202 MODEL A4D-2 REPORT 40635

#### DESCRIPTION:

Right hand main gear upper mass vertical accelerometer. This transducer measures accelerations at aircraft station X = 40, Y = 263.4, and Z = -43.8.

#### CONSTANT:

 $G's = 19.433 \delta/\Delta / 50K$  Ohms Resistor Calibration (up scale, mass down)

### CHARACTERISTICS:

### TRANSDUCER

Type - Statham A5A-50-380

Serial No. - 3024

Natural Frequency - 720 cps, Mount 987.9 cps

Damping - 1.00, Mount 0.009

#### GALVANOMETER

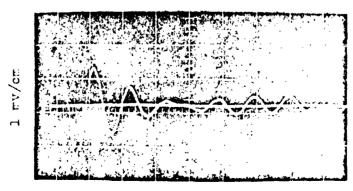
Type -7-342

Serial No. - 7243

Resistance - 395.3 Ohms

Natural Frequency - 219.2 cps

Damping - 0.512



.001 sec/cm

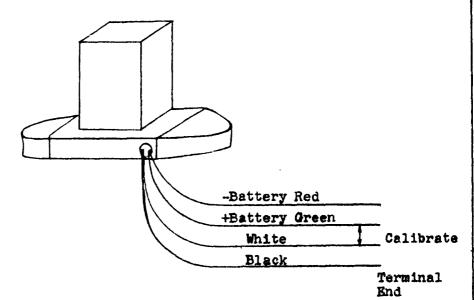
PREPARED BY H. Meriwether
TITLE Idg. Loads Investigation

PAGE 2.203

MODEL 40636

REPORT 40636

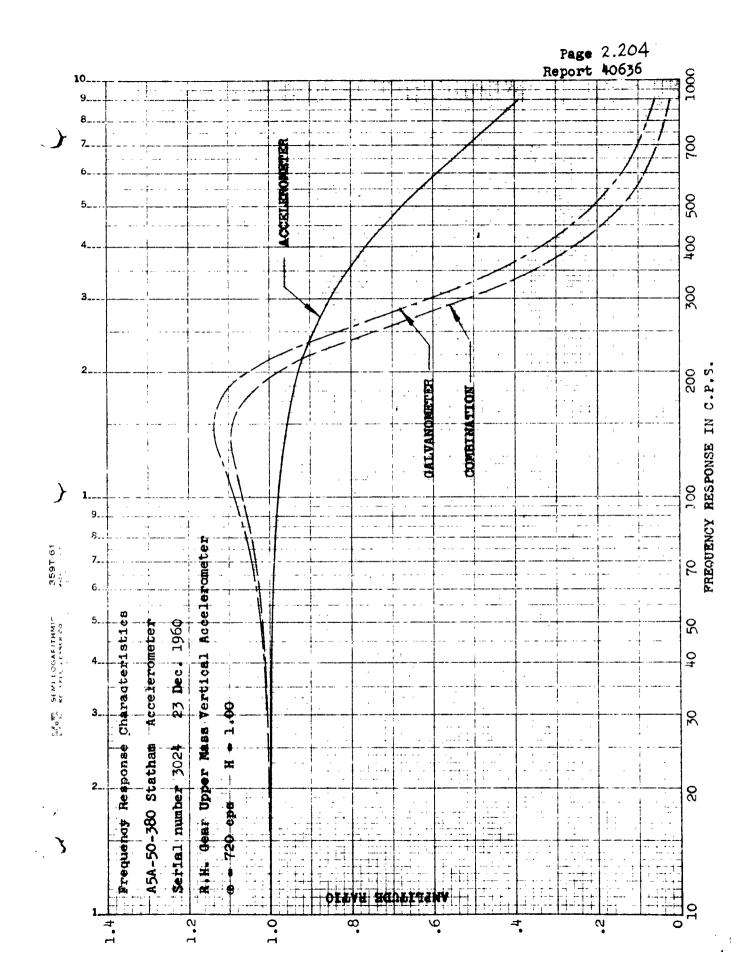
RIGHT HAND UPPER MASS VERTICAL ACCELEROMETER



Accel. label faces aft

# RECORDED:

Oscillograph Channel 2-29 for Drop Test 1-32 for Flight Test



PREPARED BY: I. E. HETTIS DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BY: TITLE: Ldg. Loads Investigation PAGE: 2.205 MODEL: A4D-2

REPORT NO. 40636

Page C. Report 40636

#### TRANSDUCER CALIBRATION

SERIAL 3024 TAG 1-3981 D.R.O. 641067 PLANE A4D089

#### CALIBRATION AFTER FLIGHT TEST PHASE

TRANSDUCER DESCRIPTION .. STHM A5A-50-380 ACCL .DR 1.00 NOMINAL RANGE .... +-50 Wn=720 

LFG

PROGRAM FOO4 ANALYST

10

/ 50K

PRIDGE VOLTS...... - 5 CHANNEL NUMBER..... 03 RUN NUMBER...... CALIBRATION DATE .....12/23/60

VOLTAGE CALIBRATION FACTORS

SHUNT CALIBRATION FACTORS

CAL-PIP FQUIVALENT

30 DEC. 1960

-.97950 01 GS /MV/V RMS SLOPE 1/RMS SLOPE -. 10709 00 MV/V/ GS

G1-CP -.19377 02 GS G1-IP •19587 02 --- 19576 92 - 19482 02 G2-TP G2-CP

RMS INTERCEPT .52067 02 GS

LOAD		UP-Se	CALF ATION	UP-SCALE PERCENT DEVIATION	DOWN-SCAL DEVIATIO		AVFRAGE DEVIATION
-,50000	02	48237	-01	05	48237 -0	05	48237 -01
40000	02	21076	<b>0</b> 0	•21	20821 0	0021 .	·12755 -02
30000	0.2	31264	00	•31	27391 0	0027	·19366 -01
20000	02	29931	0.0	• 30	32914 0	0033	-•14915 -01
10000	02	45357	00	• 45	37390 0	0037	·39835 -01
.00000	-39	.45071	00	.45	42913 0	00 43	•10791 -01
.10000	02	. 34311	00	• 34	-#28535 O	00 -•29	·28881 -01
20000	02	36120	00	• 36	34057 0	0034	•10311 -01
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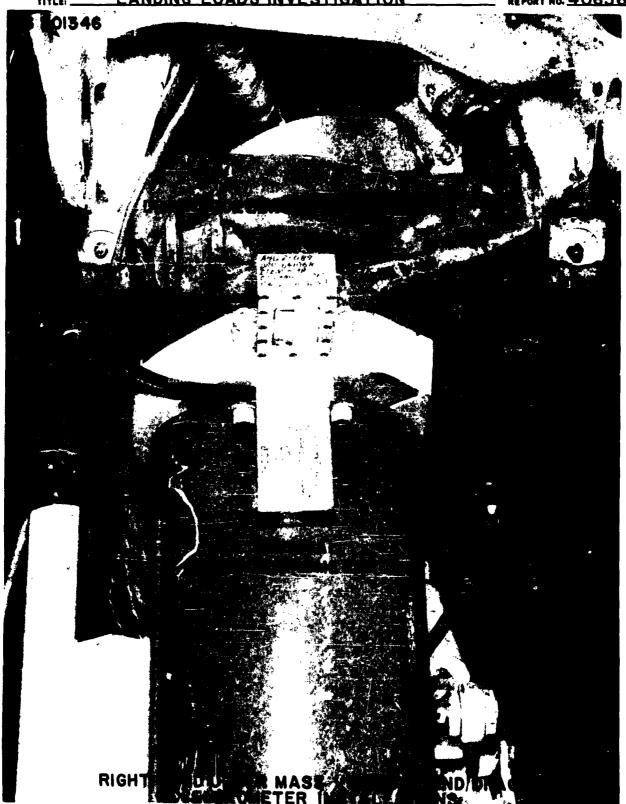
CALIB -19.272 SPECIAL

MODEL: A4D-2

CHECKED BY:

LANDING LOADS INVESTIGATION

REPORT NO. 40636



FORM 88 - 9 - 1 1 3-- 9 23 5- 0- LITUS.

3

### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY H. D. Meriwether
TITLE Idg. Loads Investigation

PAGE 2.207 MODEL A4D-2 40636

DESCRIPTION:

Right hand gear upper mass longitudinal accelerometer. This transducer measures accelerations at aircraft stations X = 40.0, Y = 263.6, and Z = -43.0.

### CONSTANT:

 $G's = 12.095 \, \delta/\Delta / 50K \, Ohms \, Resistor \, Calibration$  (up scale, mass aft)

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham A5A-30-350

Serial No. - 3901

Natural Frequency - 420 cps

Damping - 1.05

No mount effects measurable.

#### GALVANOMETER

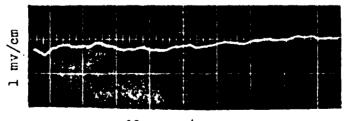
Type - 7-342

Serial No. - 7317

Resistance - 349.6 Ohms

Natural Frequency - 225.1 cps

Damping ~ 0.574



.001 sec/cm

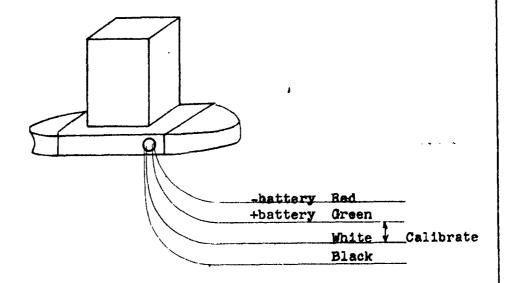
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2.208

PREPARED BY H. Meriwether
TITLE Ldg. Loads Investigation

MODEL REPORT

# RIGHT HAND UPPER MASS LONGITUDINAL ACCELEROMETER

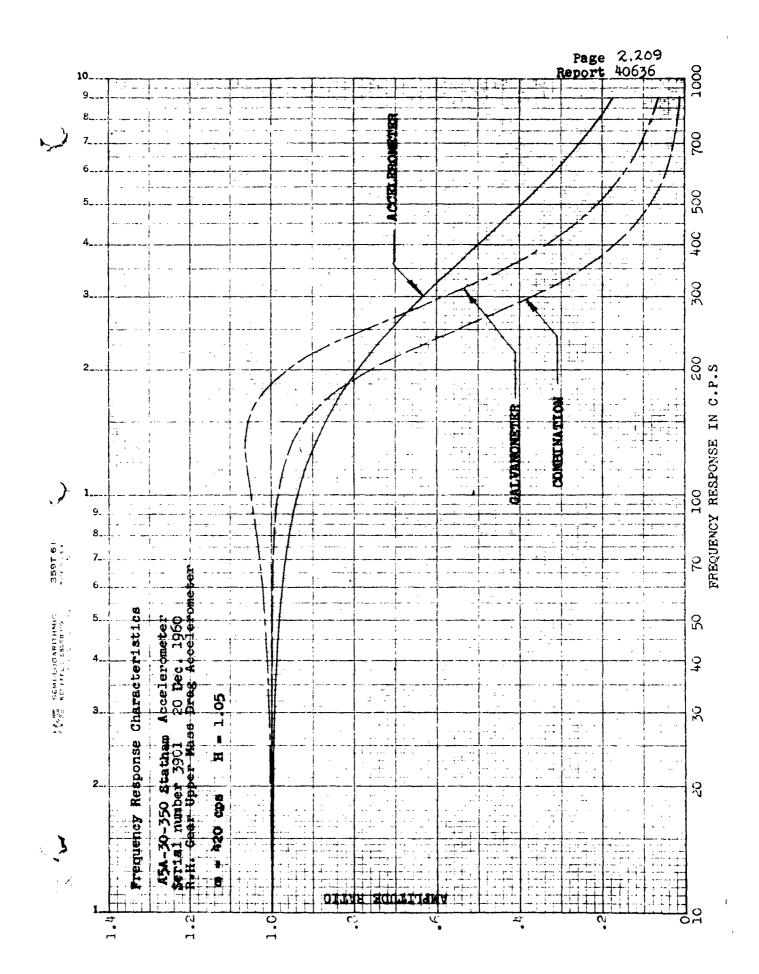


Accel. label faces down

### RECORDED:

Oscillograph Channel 2-31 for Drop Test 1-34 for Flight Test

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PREPARED By H. Meriwether
TITLE Ldg. Loads Investigation

PAGE 2.211 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

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Left hand main gear upper mass vertical accelerometer. Aircraft station X = -40.0, Y = 263.4, Z = -43.8, gear extended.

### CONSTANT:

G's =  $18.532 \text{ B/}\Delta$  / 50 K Ohms Resis. Calib. up scale, mass down

### CHARACTERISTICS:

### TRANSDUCER

Type - Statham A5A-50-380

Serial No. - 3022

Natural Frequency - 680 cps, mount 833.9 cps

Damping - 0.90, mount 0.0075

#### GALVANOMETER

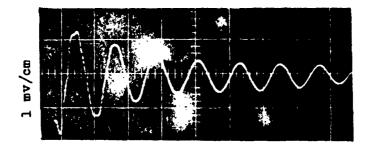
Type - 7-342

Serial No. - 7320 (Drop Tests and Flight Test Landings 138 through 209); 7275 (Landings 1 through 137)

Resistance - 403.2 Ohms

Natural Frequency - 225.6 cps

Damping - 0.520

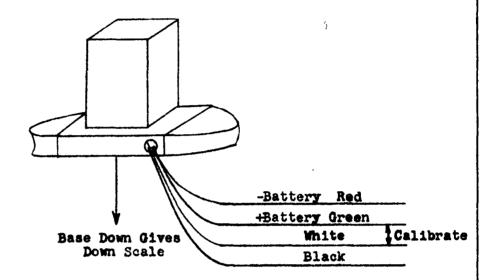


.001 sec/cm

PREPARED BY H. Meriwether
TITLE Ldg. Loads Investigation

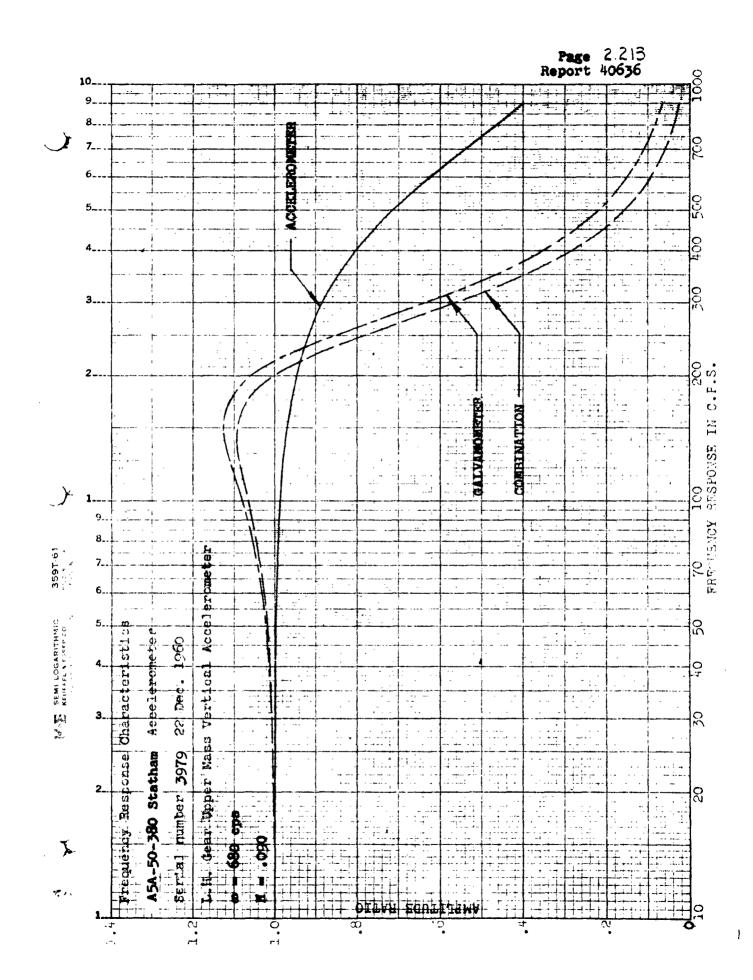
PAGE 2.212 MODEL 40636

## LEFT HAND UPPER MASS VERTICAL ACCELEROMETER



# RECORDED

Oscillograph Channel 1-33 for Drop Test 1-31 for Flight Test



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4	F	PREPARED BY	I. E. Harris Leads Invest	igation			PAGE 2.214  MODEL 44D-2  REPORT 40636
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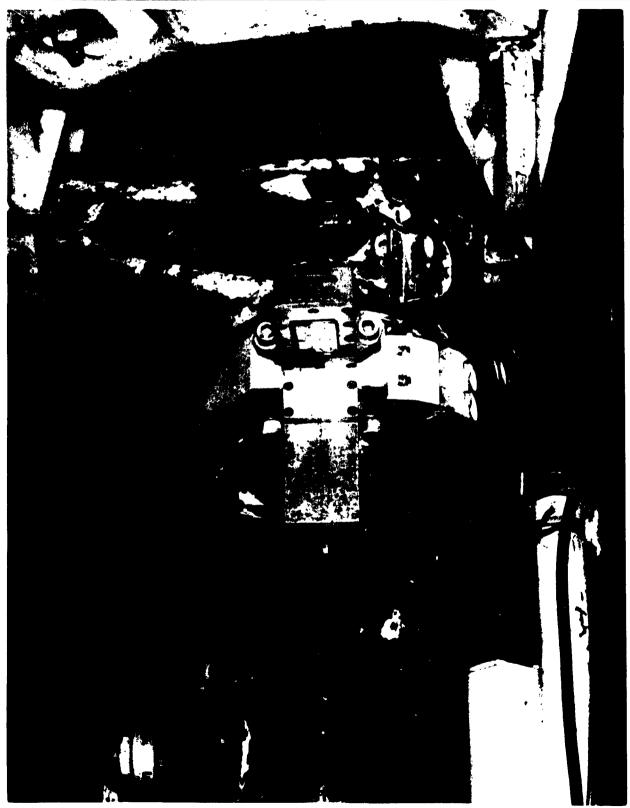
DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BY:

LANDING LOADS INVESTIGATION

REPORT No. 40636

PAGE: 2.215



PREPARED BY H. Meriwether
TITLE Ldg. Loads Investigation

PAGE 2.216

MODEL A4D-2

REPORT 40636

#### DESCRIPTION:

Left hand main gear upper mass longitudinal accelerometer. Aicraft stations X = -40.0, Y = 263.6, Z = -43.0.

#### CONSTANT:

 $G's = 11.84 \delta/\Delta / 50 K Ohms Resis. Calib.$ Up scale, mass aft

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham A5A-30-350

Serial No. - 3899

Natural Frequency - 530 cps no measureable mount effect

Damping - 1.50

## GALVANOMETER

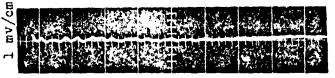
Type - 7-342

Serial No. - 7456

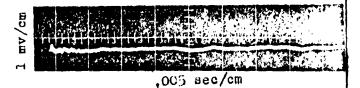
Resistance - 370.5 Ohms

Natural Frequency - 217.0 cps

Damping - 0.578



.001 sec/cm



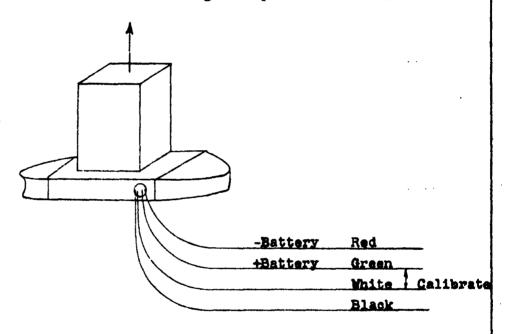
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PREPARED BY H. Meriwether
TITLE Ldg. Loads Investigation

2.217 REPORT 40636

## LEFT HAND UPPER MASS LONGITUDINAL ACCELEROMETER

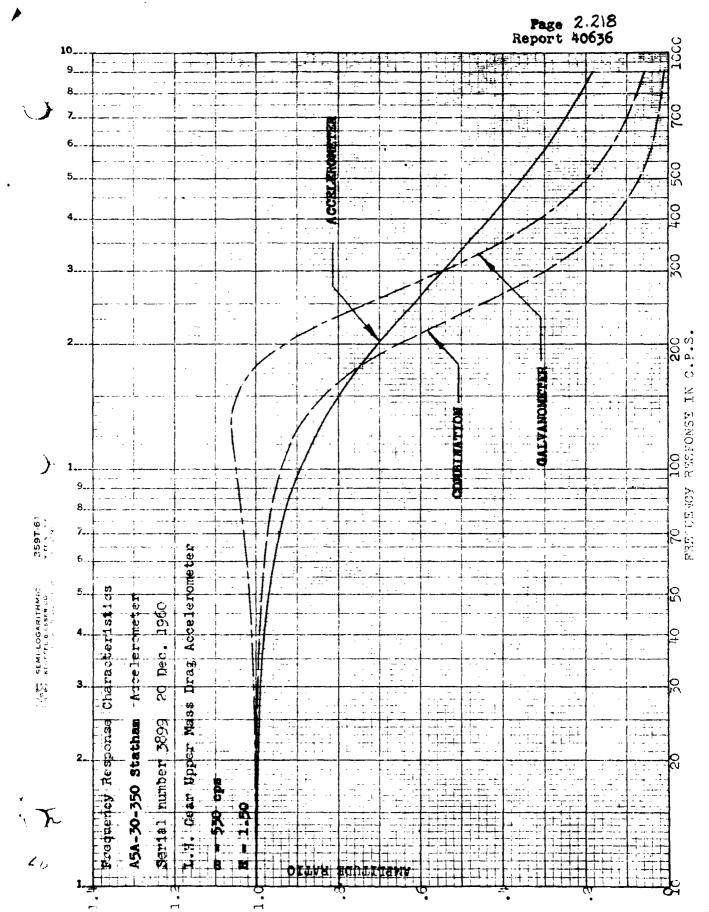
Base down gives up scale deflection



Accel. label faces down

## RECORDED:

Oscillograph Channel 1-34 for Drop Test 1-33 for Flight Test



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PREPARED BY Meriwether, Harris
TITLE Idg. Loads Investigation

PAGE 2.301 Model 40636

# Wheel Position

Magnetic pick-ups were installed on the wheel brake assembly as shown on Pages 2.303 and 2.305. Metal nail heads were attached to the wheel rim, 10 degrees apart, and passage of these nail heads past the pick-up produced blips on the oscillograph trace.

PREPARED By H. D. Meriwether
Tive Ldg. Loads Investigation

MODEL REPORT

## DESCRIPTION:

Right hand wheel position pickup. This transducer measures wheel angular position with respect to the gear axle Ç.

## CONSTANT:

36 PIPS/Rev.

### CHARACTERISTICS:

#### TRANSDUCER

Type - Electro 3010A

GALVANOMETER

DROP TESTS

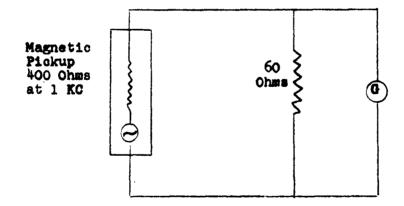
FLIGHT TESTS

Type - 7-326

7-323

Serial No. - 5040D

9298



### RECORDED:

Oscillograph Channel 2-17 for Drop Test 2-19 for Flight Test

FORM LB25- S- 1A (3-52)

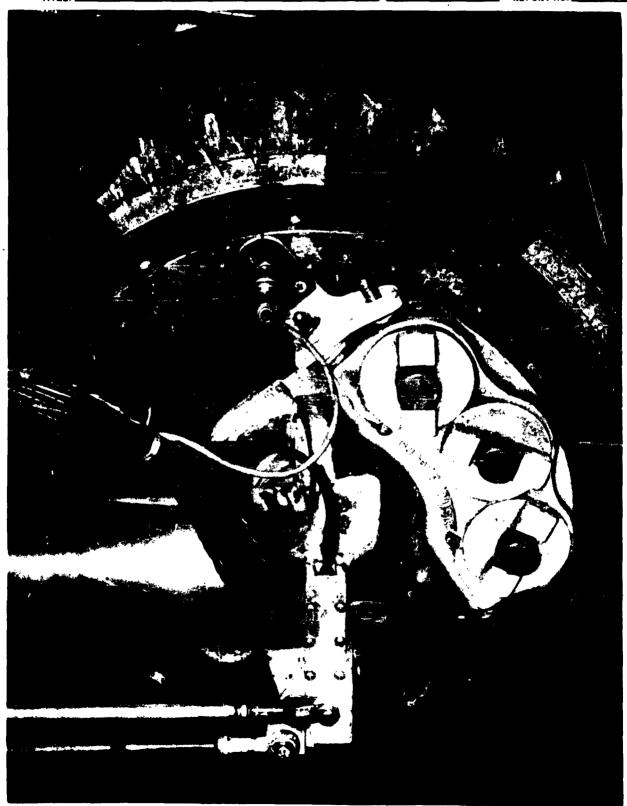
DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 2.303

CHECKED BY:

LANDING LOADS INVESTIGATION

REPORT NO. 40636



10/

PREPARED BY H. D. Meriwether
Title Ldg. Loads Investigation

PAGE 2.304 MODEL 40536

## DESCRIPTION:

Left hand wheel position pickup. This transducer measures wheel angular position with respect to the gear axle Q.

## CONSTANT:

36 PIPS/Rev.

## CHARACTERISTICS:

## TRANSDUCER

Type - Electro 3010A

#### GALVANOMETER

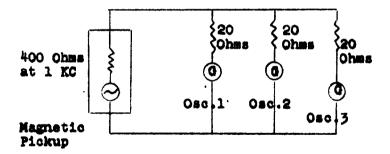
DROP TESTS

Type - 7-326

Serial No. - 539DD

FLIGHT TESTS 7-323

8548



# RECORDED:

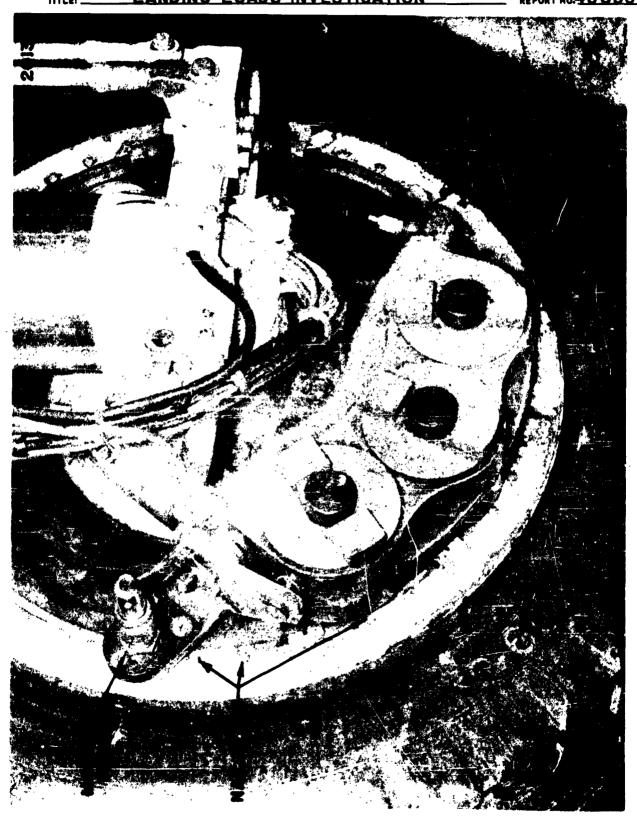
Oscillograph Channel 2-18 for Drop Test 2-32 for Flight Test

FORM LB25- S- 1A (3- 52)

DOUGLAS AIRCRAFT COMPANY, INC.

LANDING LOADS INVESTIGATION

PAGE: 2.305 REPORT NO.40636



FORM 25-9-1 ( 1-52)

PREPARED By H. D. Meriwether Tire Ldg. Loads Investigation MODEL REPORT

### DESCRIPTION:

Left hand wheel position pickup. This transducer measures wheel angular position with respect to the gear axle centerline. See DAC drawing 22542 for mounting details.

## CONSTANT:

36 Pips/Rev.

# CHARACTERISTICS:

## TRANSDUCER

Type - Electro 3010A

### GALVANOMETER

DROP TESTS

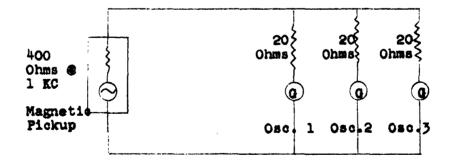
Type - 7-326

Serial No. - 7055

FLIGHT TESTS

7-323

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### RECORDED:

Oscillograph Channel 1-15 for Drop Test 1-35 for Flight Test

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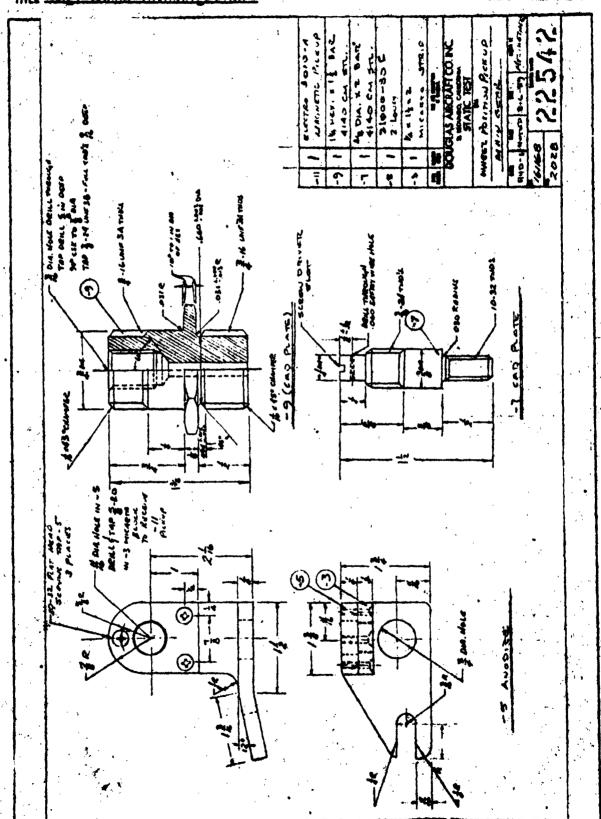
FGGW #8-6-8 ( \$-52) c o umo

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## DOUGLAS AIRCRAFT COMPANY, INC.

PREMIER BY H. Merivether
Time Life. Loads Investigation

PAGE 2.307 Moote A0635



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PREPARED	my _M	eriv	ether	Har	cia
TITLE	idg.	Load	s Inv	estige	ation

FORM 95.4 4

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PAGE 2.401
MODEL A4D-2
REPORT 40636

## Strut Positions

The main landing gear strut positions were measured with a slide wire position transmitter of Douglas Aircraft Company design, shown on Pages 2.406 through 2.410. Photographs of installations on the airplane are shown on Pages 2.411 and 2.412. A special calibration circuit and control box was used for the strut position transmitters. A schematic of this circuit appears on Page 2.413 and a photograph of the control box is shown on Page 2.414.

PREPARED BY H. D. Mariwether
TITLE Ldg. Loads Investigation

PAGE 2.402 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Right hand main gear strut position. This transducer measures relative displacement of the piston and cylinder.

#### CONSTANT:

Inches =  $16.0 \, 5/\Delta$  / Pot Setting (fixed)

#### CHARACTERISTICS:

TRANSDUCER - DAC Design ES 2621

Type - Slide Wire

#### GALVANOMETER

Type - 7-324

Serial No. - 6056

Resistance - 79.55 Ohms

Natural Frequency - 299.0 cps

Damping - 0.538

#### RECORDED:

Oscillograph Channel 2-6 for Drop Test 2-17 for Flight Test

FREQUENCY CYCLES/SEC

FORM 25-5 (

PREPARED BY H. D. Meriwether
TITLE Ldg. Loads investigation

PAGE 2.404 MODEL 40636



This transducer measures the position of the left hand strut.

#### CONSTANT:

Stroke - 16.0 5/A

#### CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Drawings 2617, 2618, 2619, 2620 and 2621

#### **GALVANOMETER**

Type - CEC 7-324

Serial No. - 6234

Resistance - Galvo sees 80.15 ohms

Natural Frequency - 297.0 cps

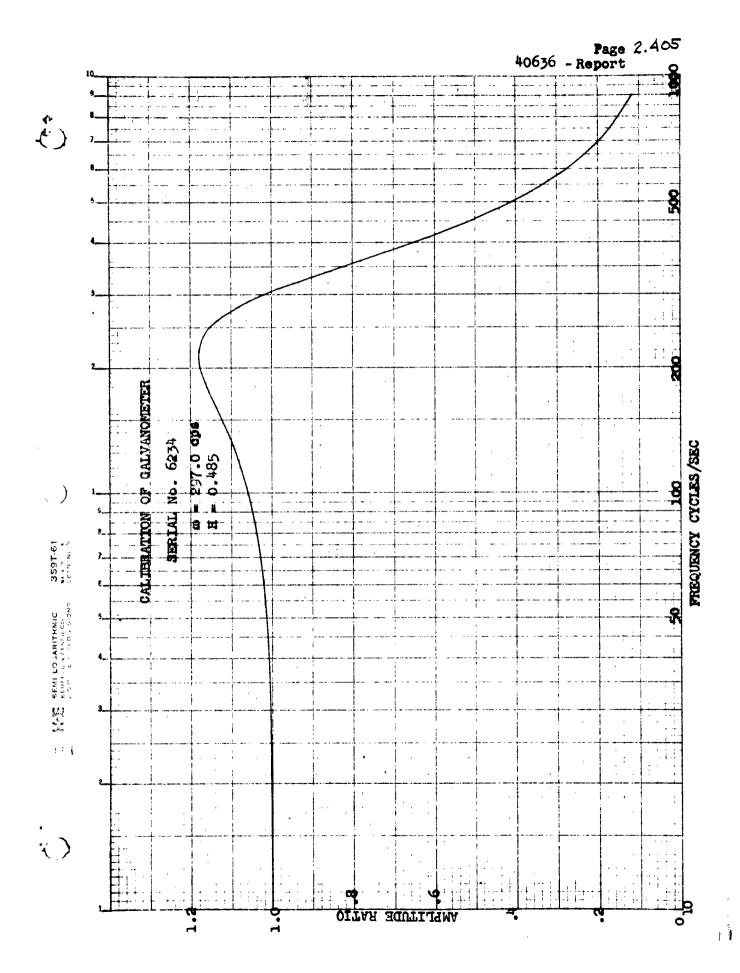
Damping - H = 0.485

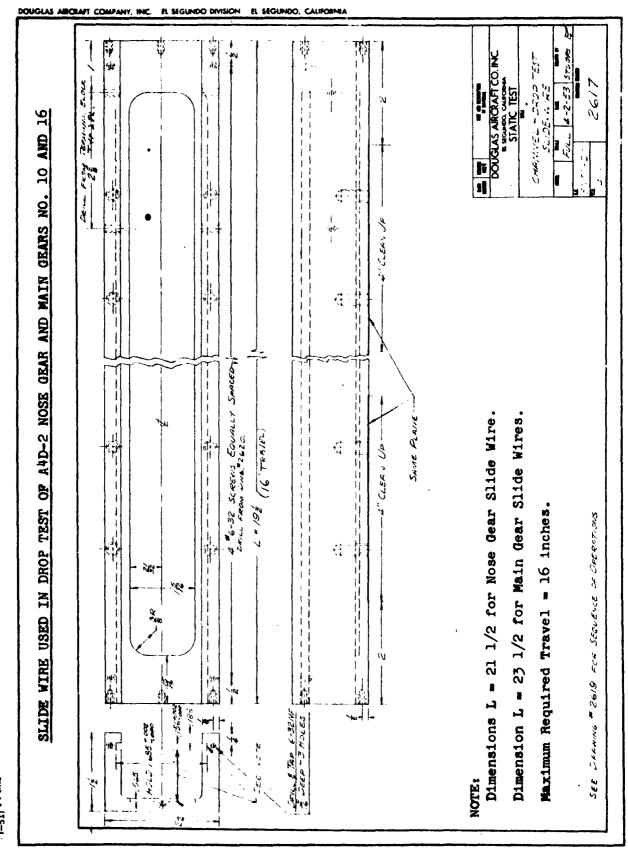
#### RECORDED:

Oscillograph Channel 1-6 for Drop Test 2-30 for Flight Test

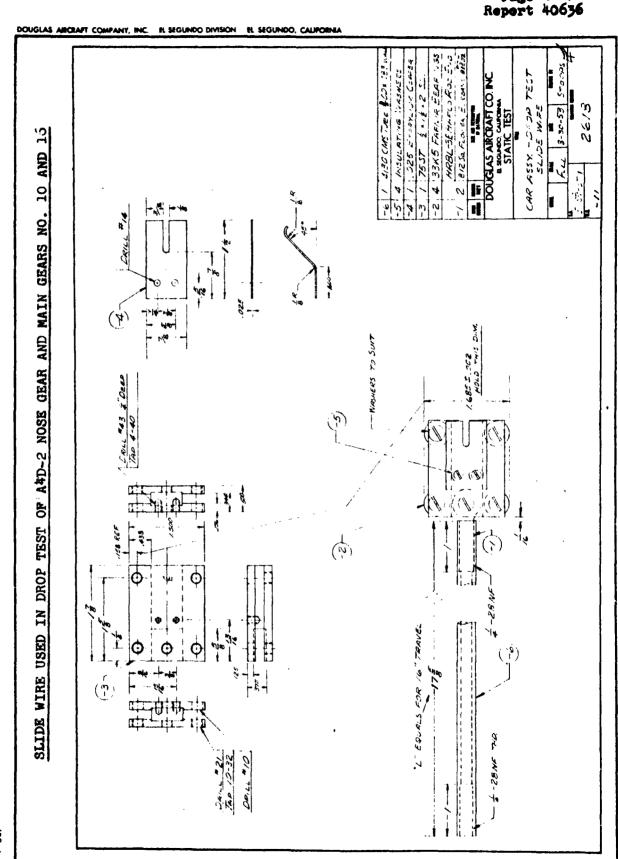
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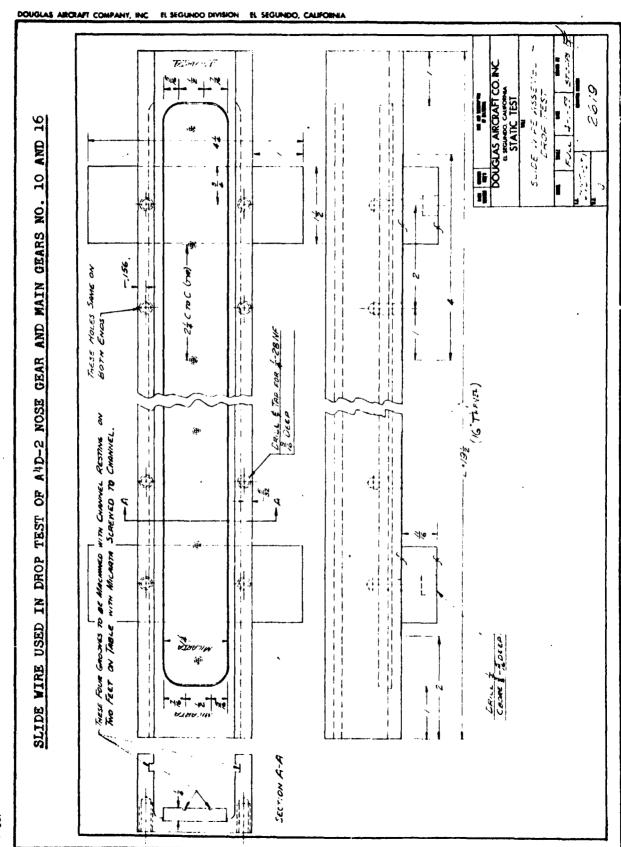
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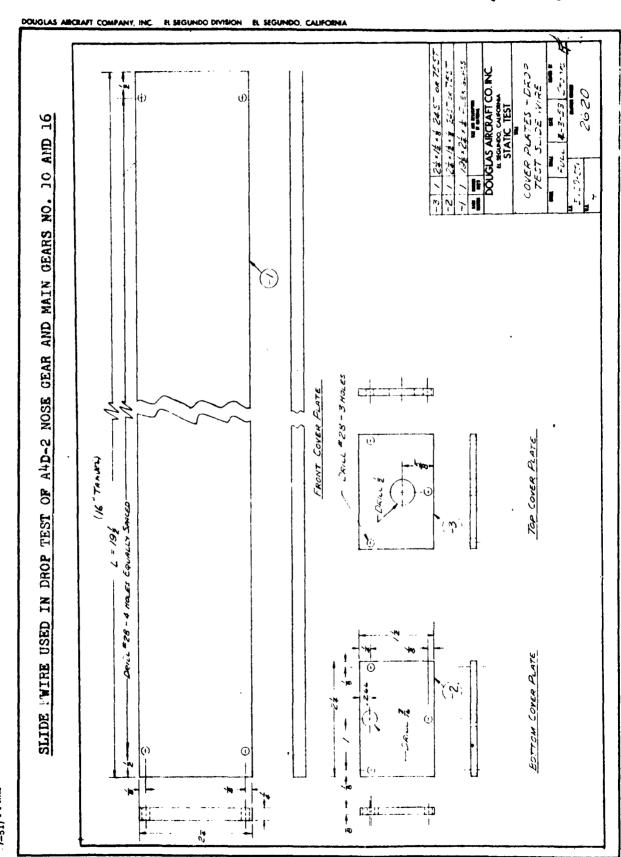


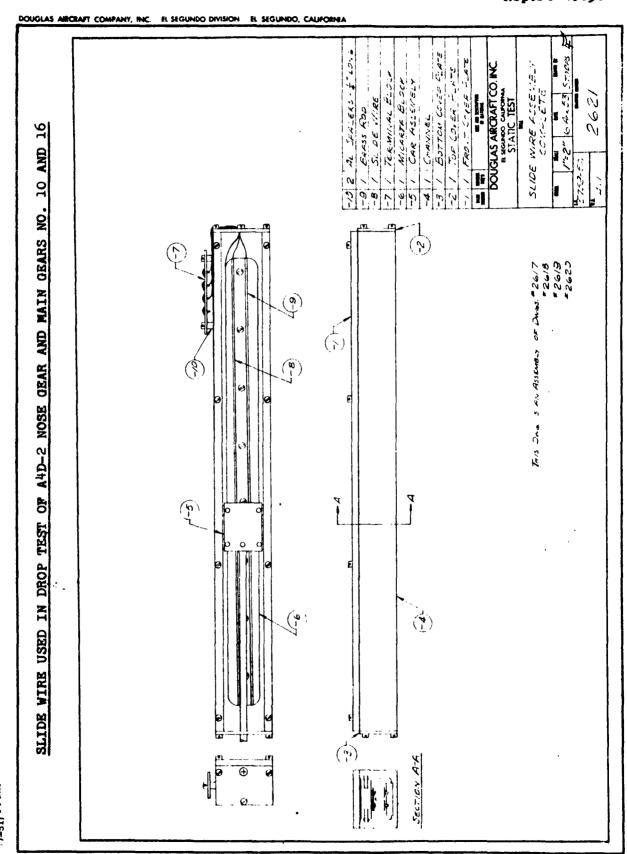
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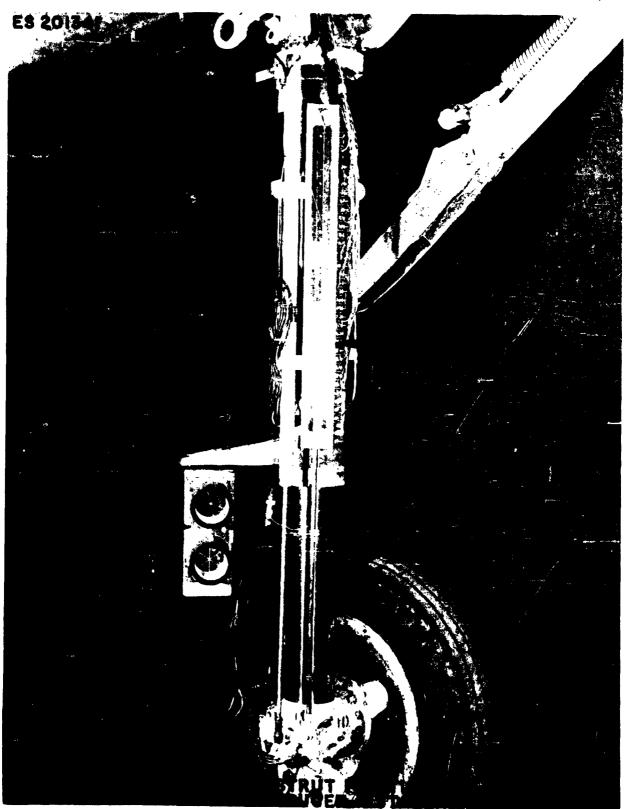
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LANDING LOADS INVESTIGATION

REPORT NO. 40636



PAGE: 2.412

MODEL: A4D-2

REPORT NO. 40636

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FORM 30-21-3

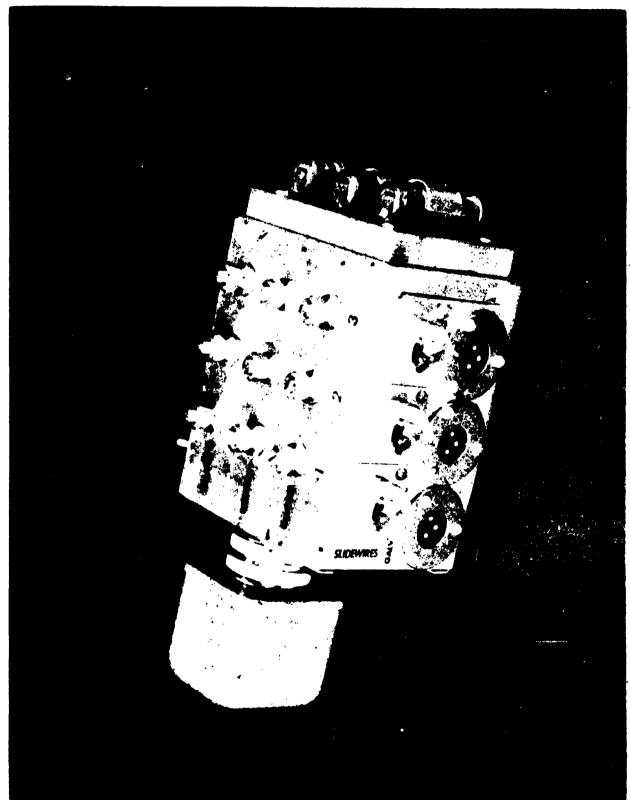
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CHECKED BY:

TITLE: LANDING LOADS INVESTIGATION

PAGE: 2.414 MODEL: A4D-2

REPORT NO. 4 0636



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PREPARED BY MGriwather, Harris
Title Ldg Loads Investigation

PAGE 2.415 MODEL A4D-2 REPORT 40636

#### Strut Velocity

The collapse rate of the main landing gear strut was measured with a Sanborn magnetic type transducer. A photograph of the installation on the airplane is shown on Page 2.420. A special calibration circuit and control box were used for the transducers. A schematic and photograph of the circuit and control box appear on Pages 2.421 and 2.422 respectively. A typical oscillograph record of a calibration of a velocity generator and resulting data are shown on Fages 2.423 through 2.433.

A comparison of various types of velocity measuring devices is shown on Pages 2.434 and 2.435. The wiring diagram used with the Kollsman velocity generator is shown on Page 2.436. This device was received with landing gear No. 10, but was not utilized for the Douglas Aircraft Company program.

FORM 28-8-9 (3-53] s s siths

PREPARED BY H. D. Meriwether
TITLE Ldg. Loads Investigation

PAGE 2.416
MODEL 40636

#### DESCRIPTION:

Right hand main gear strut velocity. This transducer measures relative velocity between the piston and cylinder.

#### CONSTANT:

Pt/Sec. =  $21.34 \text{ B/}\Delta$  / 65K Ohms Resistor Calibration

#### CHARACTERISTICS:

#### TRANSDUCER

Type - Sanborn 10 LV 17-X1

Serial No. - I-7327

#### GALVANOMETER

Type - 7-342

Serial No. - 4555

Resistance - 364.2 Ohms

Natural Frequency - 220.1 cps

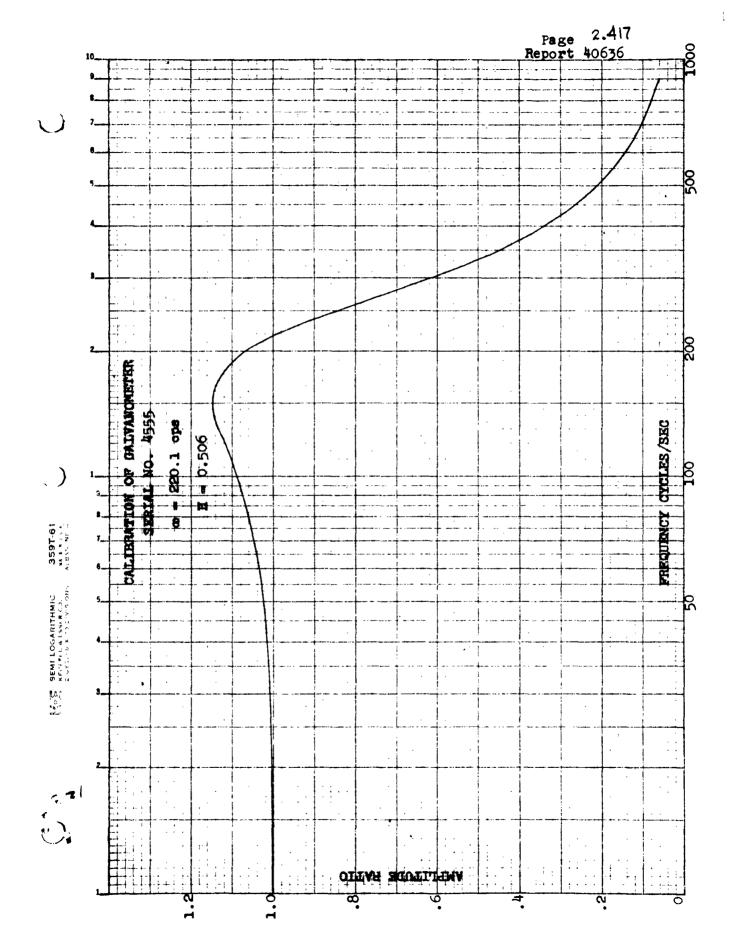
Damping - 0.506

#### RECORDED:

Oscillograph Channel 2-7 for Drop Test

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PREPARED BY H. D. Meriwether
TIVLE Idg. Loads Investigation

PAGE 2,4\8 MODEL 44D-2 REPORT 40636



This transducer measures the left hand oleo strut velocity of compression. See photographs ES 191496 and 201341.

#### CONSTANT:

Velocity (FPS) = 21.73 8/A

#### CHARACTERISTICS:

TRANSDUCER - Sanborn LVsyn

Type - 10 LV 17-X1

Serial No. - 2

Stroke - 22 inches

Working Range - 20.5 inches

GALVANOMETER - CEC

Type - 7-342

Serial No. 5097

Resistance - Galvo sees 350.9 Ohms

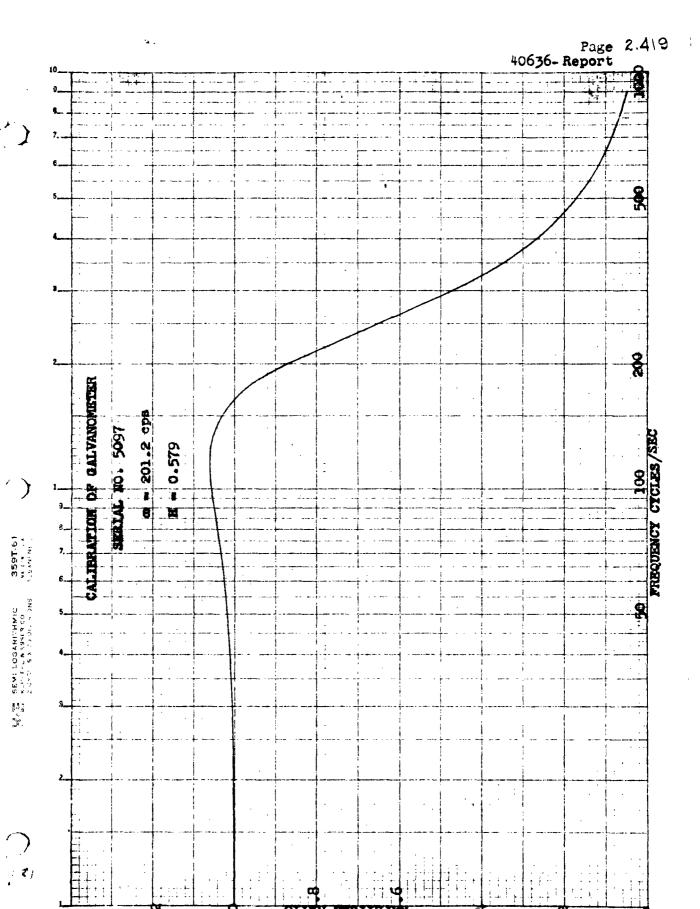
Natural Frequency - 201.2 cps

Damping - H = 0.579

#### RECORDED:

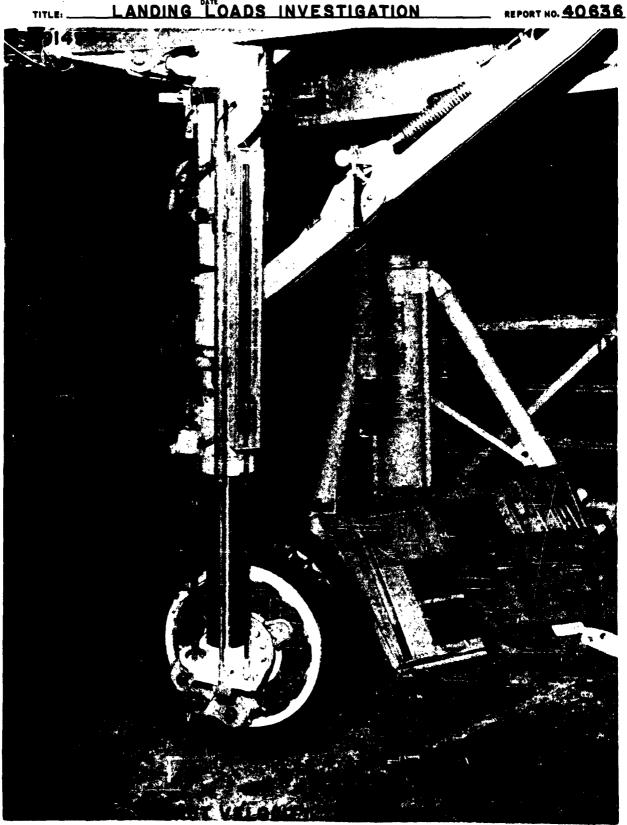
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Oscillograph channel 1-7 for drop test



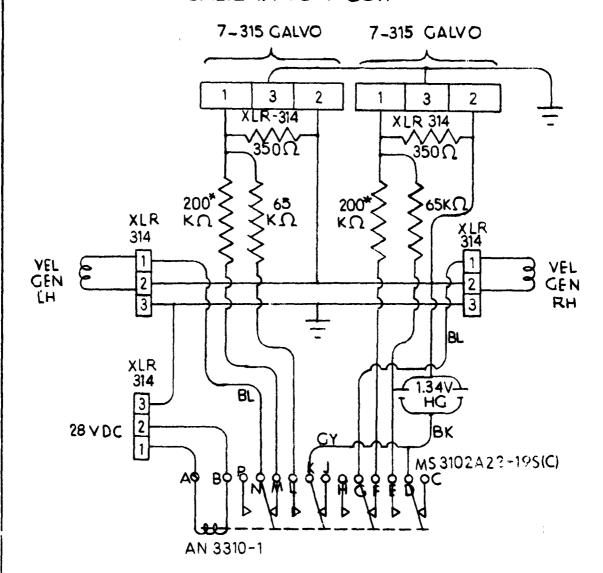
LANDING "LOADS INVESTIGATION

PAGE: 2.420 MODEL: A4D-2



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# VELOCITY CENERATOR CALIBRATION BOX



NOTE \*SUBSTITUTE 1.2 MEGS WHEN ALNICO MAGNET IS USED

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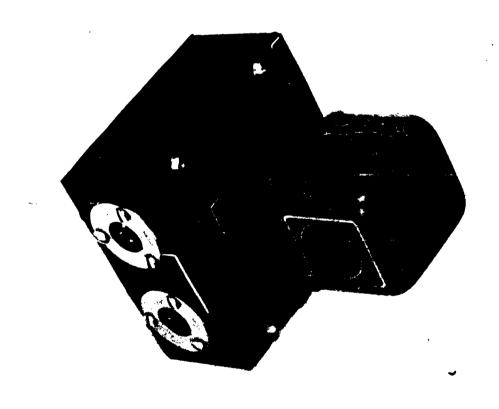
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LANDING LOADS INVESTIGATION

REPORT NO. 40636

ES 194130



DOUGLAS AIRCRAFT COMPANY, INC. EL SECUNDO DIVISION

H.D.MERIWETHER DATE 15 FEB 61 TITLE LANGING LOADS INVESTIGATION

REPORT NC.

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1	220000000000000000000000000000000000000	1	120872	447 -	.45015	120872
1	2	1	121194	449	.45217	121194.
1	2	1	121515	453		121515
1	2	1		447	.45015	121937
1	2	1	122153	4 4 6	.45.116	122158
1	2	Ť	122480	446	.44914	122480
1	- 6-	1	122601	1445	.44214	122601
. 1	?	1	123123	445	.44214	123123
, 1	. 2	1	123444	441	.44411	123444
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2148	2.177	213727	.775			
4	1497	. 644 <sup>A</sup>	4285.755	-4214.175	. 41	4411 : 3
2178	1.976	217852	.550			•
£	1468	.912	3905.788	-4167.619	. 4.3	2578
2177	7.531	217923	. 4.34	•		•
Δ.	1430	.281 A	3957.688	-3537.466	. 3	9577
2212	1.000	216796	.266	•		,
Δ.	1411	.837	3757.753	-3499.540	_ 4	3102
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#### DOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

PREPARED BY H.C.MERINETHER
DATE 15 FEB 61
TITLE LANDING LOADS INVESTIGATION

PEDEL AND-2

TEST	RUN	CHANNEL	LOAD	QUI DASP	x	<b>Y</b>
1	2	1		973		•
1	2	1	106085	379	.30167	106085
1	2 2 2	1	105406	. 378	.33065	105406
1	2	1	106728	379	.38167	106.723.
1	2	1	107049	38]	.38570	107049
1	A 2 2 (4 2)	. 1	107370	395	.33771	107370
1	2	1	107692	389	. 39174	107692
1	2	1	108013	371	·39376	109013.
}	2,	I	108335	392	.39476	108333
• 1	2	1	108656	. 393	.39577	108656
1	2 2 2	1	108978	-395	.39773	108978
. 1 .	2	٦ ,	107299	376	.39879	107299
1	i.	1	109621	403	.40584	199621
1	2	1	109942	406	.40386	109942
1	2	Ţ	110264	: 411	.41390	110264 >
1	5	1 ,	110535	417	.41994	110585
1	2	1	110907	418	-42075	110907
1	2	1	111229	420	.42296	111223
ļ	ĵ.	1	111550	425	-42300	111550
1	2	1 -	111871	421	.42397	111871
1	2	1	112173	423	.42598	112193
1	Ê	1	112514	423	.42592	112514
1	0.000000000000000000000000000000000000	1.	112035	421	.42397	112835
1	2	j	113157	422	.42497	113157
1	2	1	113478	421	.42397	113478
1	<i>(</i>	1	113800	419	.42195	113800
	· 🗶		114121	4?C	.42296	114121
1	2	Ý	114443	425	.42800	114443
i	4	1	114764	432	.43505	114764
,	. 4	,	115086	433	.43605	115086
1	<u>.</u>		115407 115729	435 439	.43807	115407 115729
1	•	;		437	.44209 .44008	116050
,	<b>4</b> .	;	145050	443	.44612	116372
;	2	,	116372 116693	433	.44239	116673
' 1	- 4	1	117015	4 3 9 4 3 6	.43907	117015
,	<b>F</b>	• 1	117336	438	.43603	117336
;	2	i	117658	430	.43303	117658
i	2		117979	428	.43102	117979
i	2222222	•	118300	426	.42900	118300
1	5	* · <b>1</b>	118622	425	.42800	118622
1.	<b>4</b>	1	118943	428	•42000 •42398	118943
1 .	2 :	1	117265	429	•43202	119265
i	2		119586	428	-#3102	119586
1	2	"·	119908	433	.43605	119908
, <u>"</u>	• .	¥*	4 17700	7.7.7	•-2002	117708

### GOUGLAS AIRGRAFT COMPANY, INC. : EL SEGUNDO DIVISION

PREPARED BY H.D.MERIMETHER
DATE 13 FEB 61
TITLE LANDING LOADS INVESTIGATION

MODEL AND-2

		. *		*		•
rest	RUN'	CHANNEL	LOAD	READING	X	Y
1	2	1		973		
1	. 2	1	91943	323	.32528	91940
1		. 1	72261	323	.32528	92261
,	Ž	1	72383	323	.32528	92583
i		1	72904	327	.32931	92904
i	5	i	93226	323	.32528	93226
i	2	ì	73547	323	.32523	93547
i	5		73869	323	.32528	93869
i	7	i	94190	322	.32427	94190
• ;	5	, i	74512	723	.33031	74512
i	2	i	94833	326	.33031	94833
• ;	2	;	75155	332	.37434	95155
	4.	1	75476	331	.33333	95476
,	A.	1	95799			95778
	4	1		333	.37575	
•		1	96119	333	.33535	96119
	4	1	76441	331	•33333	96441
1	4	1	96762	326	.33837	76752
i	2	1	97083	338	.34033	97083
1	2	1	97403	342	.34441	97405
ì	2	1	97726	346	. 34844	97726
3	2	1	73048	347	.34945	98042
1	N	1	78369	348	.35045	96369
1	2	1	78691	352	*35446	98691
1	2	t	97012	352	.35448	99012
1	2	, 1	99334	360	.36254	99334
1	2	1	99655	359	.36153	99655
1	2	1	99977	359	.36133	79977
1	2	7	100298	361	.36354	100298
1	2	1	100520	358	.36052	100,620
1	2	1	300944	367	.36759	100941
1	· 2	. 1	101263	363	.36556	101263
1	2	- 1	101584	366	<b>-36853</b>	101584
1	8 W 3	1	101905	368	.37059	101905
1	2	1	102227	375	.37764	102227
. 1	2	. 1	102548	378	.38066	102548
1	i.	1	102570	391	. 28369	102870
1	2	1	103191	387	.33973	103191
1	2 , 2,	1	103513	138	.39074	103513
. 1	2	t	103834	393	.39577	103834
` 1		1	104156	391	.39276	104156
1	Ž	. 1	104477	385	.38771	104477
. 1	2 2 2	1	104799	363	.36570	164799
1	ī	1	105120	382	.38469	105120
1	2	. 1	105442	379	.36167	105442
1	2	1	105763	390	.36258	105763

### CCUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

AGE 2.42

PREMARED BY H.O.MERINETHER DATE 15 FEB 61 TITLE LANDING LOADS INVESTIGATION

MODEL AND-2 REPORT NO. 40636

A. S. Harton	×e, €,		•	•		
TEST	RUN	CHANNEL	LCAD	READING	<b>X</b>	Y
1	5 & 5	1	•	978 .		
1	દ	1.	189024	751	.75251	189024
1	5	1	139345	752	.75351	127345
1	6'	, 1	159667	752	.75351	189667
INTE	ACEPT	SLOPE	1 Si	.0P= 2 SL	OPE 3	SLOPE 4
•	AVE.C	ELTA Y	MAX.+	MAX	SMITTE	א ׁנֵי
2356	3.126	216545	.326		•	
	2633	.391	6100.996	-5737.438	•00	0000
2452	6.848	214928	.674			•
	2585	.222	5896.796	-5652.657	.73	3146
2567	5.076	213334	.032	•		
*	2335	.528	5788.987	-5569.055	.73	3146
2466	3.662	214696	.298			
	2504	.908	5548.324	-5517.781	.61	234
2377	4.804	215265	.445	•		
	2474	.980	5214.614	-5466.117	.67	75 <b>3</b> 5

PREPARED BY .H.D.MERIWETHER CATE. 15 FEB 61 TITLE LANGING LCADS INVESTIGATION

MODEL AND-2 REPORT NO. 40636

### - VELOCITY SENERATOR CALIBRATION

TEST	RUN	CHANNEL	LOAD	READING	x	Y
ì	5	1		993		
1,	6	1	174879	671	167234	174279
1	6	1	175201	674	.67535	175201
1	6	1	175522	679	.68036	175522
, 1	6	. 1	175844	632	.68337	175844
1	ù	1	176165	688	\$5 <b>9</b> 58	176165
1	5	1	176427	695	.69639	176487
1	. 6	1	176808	701	.70240	176808
• 1	ć	1	177129	706	.76741	177129
1	6	1	177451	710	.71142	177451
1	6	1	177772	713	.71443	177772
1	6	1	178094	719	.71944	178094
1	6	į	176415	722	.72345	178415
1	6	Ì	178737	729	.73046	178737
1	6	1	179058	737	.73848	179058
1	i.	1	179380	727	.73046	177380
!	6	1	179701	729	.72946	179701
1	6	1	130023	721	.72244	160023
1	6	1	180344	716	.71743	180344
ļ	6	1	160666	711	.71242	180666
	5	i	180987	707	.70842	180987
	6	1	131309	710	.71142	181309
!	6	1	181630	713	.71142	181630
ļ	6	1	181952	718	.71944	181952
1	6	1	182273	726	.72745	182273
! •	. \$	!	182594	7 74	.73547	182594
!	ć	1	132916	739	.73948	182916
	6	1	183237	747	.79850	163237
1	6		187559	751	.75251	183559
,	6		163560	753	.75752	. 183880.
1	۵		134202	7:53	.75451	184202
1	5 6		154523	747	.74850	184523
,		;	154845	746	.74749	164845
1	6	•	185166	751	.75251	185156
;	6	1	185498	748	.74950	185488
1	<u>د</u> 6	1	185807	756	•75952	155803
,	6	;	156131	753	.75451	186131
		1	166452	747	.74850	186452
,	.6	3	186774	741	.74248	186774
ì	٥ ٥.	4	137095	741	.74248	137095
1 4		Ť *	157417	736	.73747	187417
;	6	. !	137733	730	.73146	197738
1	√ <b>5</b>	1	189057	730	.73146	188059
	6	. 1	1883e1 - 188702	737	.73848	188381
	U	* *	100102	741	. 742 <b>š</b> e	188702

PREPARED BY H.D. MERIWETHER DATE IS MEB 61 TITLE LANDING LOADS INVESTIGATION

MCDIL AND-2 REPORT NO. 40636

TEST	RUN	CHÂNNEL	LOAC	READING	<b>.x</b>	Y
1	5	. 1	•	998		
1	5	1	160735	628	.62926	160735
t	6	1	161056	531	. 53226	161056
1	6	-1	161377	525	.62625	161377
1.	6	1	161699	525	.62625	161699
1	& ·	. }	162020	529	.63026	162020
Ì	6	1	162342	632	.63327	162342
1	. 6	1	162663	542	.64327	162663
1	t	1.	162785	651	.65230	162995
. }	6	1 .	163306	657	<b>-65832</b>	163306
1	Ó	ì	163629	662	.66433	163628
1	6	1	163949	562	. 66333	153949
1	6	į	164271	566	.66733	164271
1	5	1 .	164592	667	.65834	164592
1	6	1	164914	533	.66934	164914
1 .	~ ó	3	165235	667	.66834	165235
1	ć.	1	165557	670	.67134	165557
1	6	ì	165873	672	.67335	165879
1	5	. 1	166199	578	.67936	166197
1	5	1	166521	156	.68236	166521
1	4	1	166042	621	•63236	166842
1	6	1	167164	578	.57925	157164
1.	ć	1	167485	<b>680</b> ,	.63136	167485
1	6	1	167807	578	.67936	167807
1	5	}	168128	670	.67134	168128
1	. 5	, 1	168450	685	.65633	158450
1	ć	1	168771	\$ 50	.66333	166771
1	5	1	169093	662	.66333	157093
1	5 .	1	162414	665	.65633	169414
3	6	1	169736	666	.66733	169736
1	6	1	170057	672	.67335	170057
1	, 6	1	170379	6.79	.68636	170379
1	6	1	170700	691	. 69238	170700
ı	5	1	171022	700	.70140	171022
1	٠ ۵	. 1	171343	707	.70842	171343
1	6 -	1	171664	709	.71042	171664
1	6	1	171986	703	.70441	171986
1	8	1	172307	578	.69940	172307
}	6	1	172629	693	.69479	172629
1	6		172950	687	-69033	172950
1	• 5	1	173272	ନେଷ	.68938	173272
1	6	. 1	173593	579	.68036	173593
1	6	, <b>1</b>	173915	678	.67936	173915
1	. <u>6</u> .	. <u>1</u>	174236	673	. 67435	174236
. 1	E		174558	673	.67435	174558

## DOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

PREPARED BY H.C. MERIWETHER
DATE TO FEB 61
TITLE LANDING LOADS INVESTIGATION

MCDCL AND-2 REPORT NO. 40636

INTERCEPT AVE.DEL	SLOPE TA Y	SLOPE MAX.+	2 SLOPE	3 SLCPE 4 CMITTED X
32349.176 2532.2	217657 • 6 70	504 58 <b>31.46</b> 7	-3281.136	.00000
33637.612 2476.5	217742.0		-5203.607	.73647
.32012.289 2435.3	217933. 24		-5139.300	.67836
33281.518 2384.2	219051 <b>.</b> 9		-5968-110	.73348
34747.674 2331.7	215892 <b>.</b> 70		-4995.925	.74248

#### COUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

PREMARED BY H.O.MERINGTHER DATE 15 FEB 61 TITLE LANGING LOADS INVESTIGATION

MODEL AND-2 REPORT NO. 40636

#### VELOCITY GENERATOR SALIBRATION

TEST	RUN CHANNEL	LOAD	READING	X	<b>Y</b> . (1)
1	7 1		773		
Ť	7 1	157667	712	.71343	187667
1	7	187988	719	.72044	199983
, 1	7	19031d	7.76	.72745	190310
1	7.	190631	733	.73447	170631
· 1	7 🐪 1	190953	733	.73748	190953
1	7 1	191274	739	.74048	191274
1	7 ' 1	171596	733	.73447	191596
1	7 1	121917	735	.73447	191917
1	7 1	192239	723	.72445	192239
1	7	192560	718	.71944	192560
1	7	192882	716	.71743	192682
1	7	173203	713	.71443	193203
1	7	193524	718	.71944	193524
ł	7 1	173645	720	.72144	193346
1	7	194167	727	.72846	194167
1	7 1	194439	733	.73447	194489
1	7 1	174810	743	.74447	194810
1	7	195132	750	.75150	195132
}	7 1	195453	753	.75451	195453
1	. 7	175775	759	.76052	195775
1	7 . 1	196096	756	.75752	176096
1.	7	196418	753	.75451	196418
1	7	196739	750	.75150	196739
1	7 1	197061	753	.75451	197061
1	7. 1	197382	757	.75852	197382
1	7	197704	753	.75952	197704
1	7	.198025	751	.76253	198025
1	7	198346	756	.75752	198346
1	7 1.	888381	759	.75952	178669
1	7	198989	745	.74649	198939
1	7 1	179311	737	.74348	199311
1	7	199632	737	.73843	199632
1	7	199954	735	.73547	199954
1	7	200275	741	74243	200275
1	7 1	200597	745	.74749	200597
l	7 Y.	200918	753	.75451	203918
1	7, 1	201240	756	.75752	201240
			-		•

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#### DOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO CIVISION

PREPARED BY H.D.MERIKETHER DATE IS FEB 61 TITLE LANDING LOADS INVESTIGATION

MODEL A40-2 REPORT NO. 40636

TEST	RUN	CHANNEL	LCAD	READING	X	Y
1	7	1		998		•
i	7	1	175522	551	. st 232	175522
i	7	1	175844	565	.66633	175844
i	7	1	176165	658	.56934	176165
i	7	Ì	176487	671	.67234	176487
	7.	í	176808	666	.56733	176808
i	7	į	177127	673	.67435	177129
j	7	1	177451	569	.67034	177451
i i	7	i	17/772	672	.57335	177772
ì	7	į.	176094	575	.57635	178094
;	7	i	178415	673	.67936	178415
· •	7		178737	674	.67535	178737
i	7	i	179058	679	.68036	179058
. 1	7	1	179383	631	.58236	179380
i	7	i	179701	679	.68036	179701
į	7	,	180023	677	.67836	180023
. ;	7	i	120344	673	.67435	180344
` ;	7	i	180656	668	.86924	180868
i	7	i	13078?	665	. 46633	160987
i	7	i	161307	357	.66834	181309
1	7	1	131630	673	.67134	161630
,	7	i	131952	. 669	.67034	181952
i	7	1	132273	677	. 47836	182273
	7	į	182594	6.89	.67038	132594
;	7	•	182916	675	.67639	192916
1	7	i	183237	703	.75441	183237
,	7	,	183557	711	.71242	183559
į	7	i	183880	710	.71142	183880
. ;	7		184202	703	.70441	184202
í	7	i	184523	701	.70240	164523
i	7	i	184845	701	.70240	134345
1	7	i i	135166	697	.69840	185165
,	7	í	185486	637	.59038	185488
3	7	,	185807	£56	.68437	185507
•	7	1	166131	631	.6F 236	186131
•	7	•	166452	591	.62236	186452
;	7	ì	186774	677	.67836	186774
,	7	,	187095	633	·6E437	137095
	Ť	, , , , , , , , , , , , , , , , , , ,	167417	683	.68437	187417
1	7	1	187738	696	.68737	167736
k. 1	7	1	189059	571	.69238	188059
1 1	٠ ۲	1	188361	678	.59740	138381
1	7.	, 1	188702	703	.70441	138702
*	•	1	129024	708	70942	169024
:1	- , · <b>?</b> ·	1	189345	712	.71343	149345
, t	<i>r</i> .		. 167343	: 12	•11240	

PREPARED BY H. D. Meriwether
TITLE Lide. Loads Investigation

PAGE 2.436
MODEL A40-2
REPORT 40636

#### KOLLSMAN VELOCITY GENERATOR

Type - 1299-04610-0 Serial No. 2182

GREY • Pin 1
BLACK • Pin 4

ARTTOM

To C.R.C. 3 KC Carrier Amplifier, Type 1-1138

C.E.C. Oscillator Power Supply, Type 2-105A

GREEN Pin 2

• Pin 3

- 1. 1000 ops galvanometer C.E.C. Type 7-323 used.
- 2. Reference phase slot was adjusted for maximum output.
- 3. 4 arm bridge operation used.
- 4. No calibration taken readings compared to one inch on oscillograph trace.

NOT USED FOR DOUGLAS AIRCRAFT COMPANY PROGRAM.

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FORM 25 - 5 - 1 ( (= 5.1)

#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY Merivether, Harris
TITLE Ide. Loads Investigation

MODEL 40636

#### Metering Chamber Pressure

Pressure transducers were installed in the main landing struts to measure oil pressure at the base of the metering pin support. Photographs of the installations appear on Pages 2.509 and 2.510.

The right gear metering chamber pressure transducer was inoperative during the flight test phase due to an open circuit. Repair was not attempted due to the difficulty in removing the transducer.

7 ml

FORM 85-8-1 (3-51) E.S. LITHO

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#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY H. D. Mcriwether
TITLE Ldg. Loads Investigation

PAGE 2.502 MODEL A4D-2 REPORT 40636

DESCRIPTION:

Right hand main gear metering chamber pressure. This transducer measures oil pressure at the base of the metering pin support.

#### CONSTANT:

P.S.I. = 4413  $\delta/\Delta$  + 39.7 / 250K  $\Omega$  Resistor Calibration

#### CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Design E.S. 12951

Serial No. - 7B

#### GALVANOMETER

Type - 7-342

Serial No. - 4438

Resistance - 350.4 Ohms

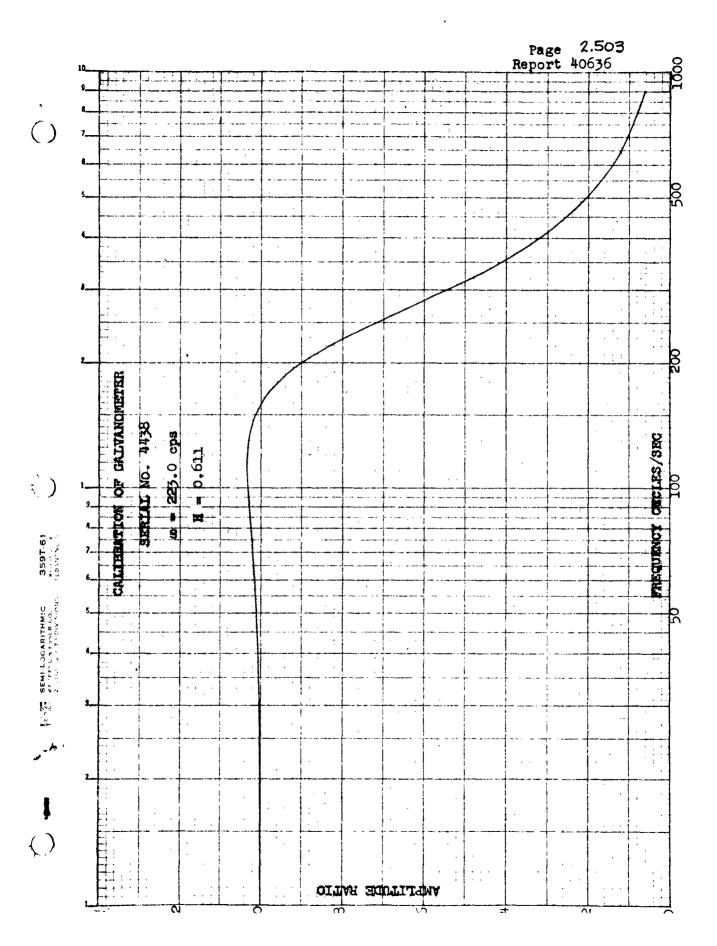
Natural Frequency - 223.0 ops

**Damping** - 0.619

#### RECORDED:

Oscillograph channel 2-9 for Drop Test Inoperative for Flight Test

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PREPARED By H. D. Meriwether
TITLE Ldg. Loads Investigation

PAGE 2.504

MODEL A4D-2

REPORT 40636

#### DESCRIPTION:

Left Hand Main Gear Metering Chamber Pressure. This transducer measures the hydraulic pressure in the oleo strut metering chamber.

# CONSTANT:

Drops 1 through 14 - PSI =  $4406 \, 5/\Delta + 39.7 \, \text{for } 250 \, \text{K}$  Ohm Calibrating Resistor

Drops 15 and Subs. - PSI =  $4358 \text{ } \delta/\Delta + 39.7 \text{ for } 250 \text{ K Ohm}$  Calibrating Resistor

#### CHARACTERISTICS:

# TRANSDUCER

Type - DAC Design ES 12951

Serial No. - 8A

Natural Frequency - Approx. 500 cps

# GALVANOMETER

Type - CEC 7-342

Serial No. - 4915

Resistance - Galvo sees 351.2

Natural Frequency - 220.0

Damping - H = 0.599

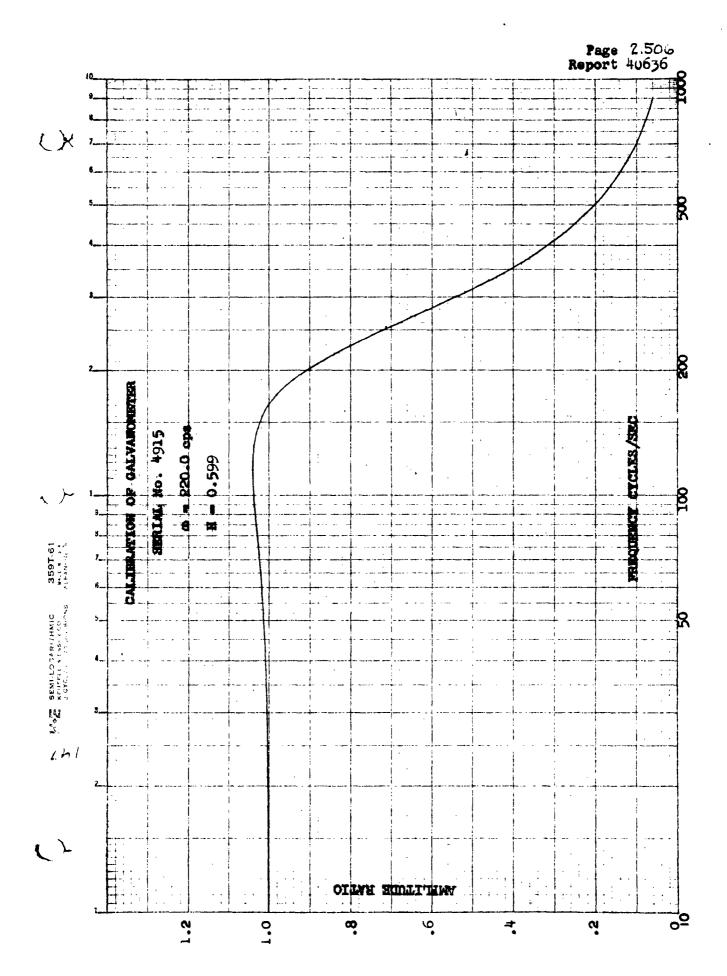
# RECORDED:

Oscillograph Channel 1-9 for Drop Test 1-16 for Flight Test

4/1

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DATE 7-16-59
PREPARED BY H. D. Meriwether
TITLE Landing Loads Investigation

PAGE 2.508 MODEL A4D-2 REPORT 40636

CONDITION

# CALIBRATION OF L. H. MAIN GEAR OIL PRESSURE PICKUP NO. 8A

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT NUMBER		CHANNEL RESPONSE IN MILLIVOLTS					
		PSI = 4400 δ/Δ <sub>8A</sub> -150					
CHANNEL TI	TLF	LHPPUO					
CHANNEL NU	MBER	1					
GAGE TYPE		AB-13					
GAGE RESIS	TANCE	350					
BRIDGE TYP	È	FULL					
GAGE FACTO	R						
BRIDGE VOL	TAGE	20V					
CALIBRATIO	N RESISTANCE	250 <b>K</b>					
CALIBRATIO	N RESPONSE	6.55	6.55	6.55			
	PSI	RUN 1	RUN 2	RUN 3			
ZERO	ZERO	0	0	0			
	<b>50</b> 0	1.26	1.34	1.34			
	1000	1.74	1.67	1.76			
	1500	2.41	2.46	2.46			
	2000	3.25	3.17	3.20			
	2500	3.95	4.03	4.00			
	3000	4.64	4.64	4.64			
	3500	5.57	5.43	5.45			
<u></u>	4000	6.10	6.13	6.15			
	4500	6.94	6.92	6.87			
1 A.	5000	7.60	7.72	7.73			
RETURN ZERO	RETURN ZERG	+.05	+.04	+.06			

PAGE: 2.509

MODEL: A4D-2

REPORT NO. 40636

LANDING LOADS INVESTIGATION

ES 189382



101	*	LB	25.	s٠	1 A
( 3	52	)			

PREPARED BY

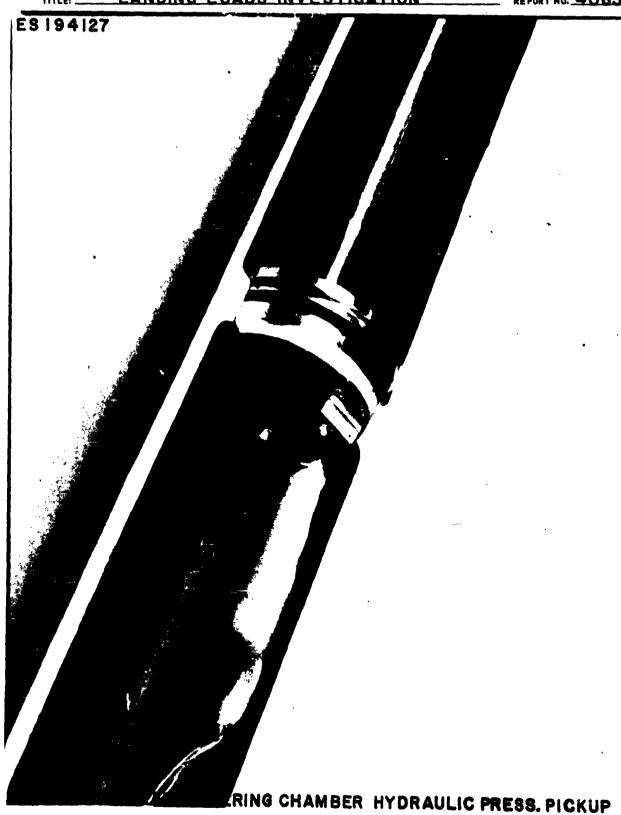
DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 2.510 MODEL: A4D-2

CHECKED BY:

LANDING LOADS INVESTIGATION

REPORT NO. 40636



FORM 25 - 9 -
1 5- 5- 21
* # 1 14

DATE		
PREPARED	by Meriwethe	r. Harris
TITLE	Idg. Loads In	avestigation

MODEL 40636

# Rebound Chamber Pressure

A pressure transducer was installed on the left main landing gear to measure pressure between the piston and the barrel. A photograph of the installation is shown on Page 2.514.

This instrumentation was not installed during the Flight Test phase and was used only during the drop test phase of the program.

451

₹ •

PREPARED By H. D. Meriwether
Title Ldg. Loads Investigation

PAGE 2.512 MODEL A4D-2 REPORT 40636

# DESCRIPTION:

Left hand gear shock strut rebound chamber pressure. This transducer measures the pressure between the main gear piston and barrel.

# CONSTANT:

PSI =  $5640 \, 5/\Delta + 39.7 / 250 \, \text{K}$  Ohms Resis. Calib.

# CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Drawing 12951

Serial No. - 11 B

Natural Frequency - No measurable resonance effects

# GALVANOMETER

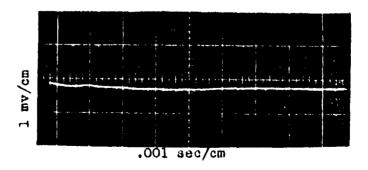
Type - 7+342

Serial No. - 7275

Resistance - 352.4 Ohms

Natural Frequency - 231.3 cps

Damping - 0.588



# RECORDED:

Oscillograph channel 1-19 for Drop Test

# DUDLAS AIRCRAFT CUMPANY, INC. EL SEGUNDO DIVISION

PREPARED BY H. D. MERIWETHER
DATE 23MAX 61
TITLE LANGING LOADS INVESTIGATION

PODEL AND-2 REPORT NO. 40636

# CALIBRATION OF PRESSURE PICKUP

			Re BOUNI	D CHAMALA		
TEST	RUN	CHAINEL	LOAD	READING	· x	<b>Y</b>
3	. 1	19		978		• •
3	1	19	300	5.3	.10023	500
9	1	19	1000	149	. 16858	1000
ρ	1	19	1500	132	• 264£4	1500
3	1 .	19	2000	3.37	.34766	2000
3	1	19	2500 -	302	. 44647	2500
•	7	1 /	3600	462	.52961	3000
ė	1	19	350L ·	540	<u>.</u> 41503	3500
<b>3</b>	1, -	19	4000	623	.71640	40,00
8	1	19	4500	699	.79613	4500
į,	1	19	5000	252	\$5.883 <b>.</b>	2000,
1.44.1	1.878	ELTA Ý S837.J	MAX.+; 503	MAX2+-	LOPE 3 SEC OMETICS X	SPE 4.
	27	-292	47.837	-06.212	600000	, .
	11.006		772 23.480	-36,921	.10023	
	36.775 14	5595. .402	21.907	~34.859	.71640	
1	44.602 10	.539.	106 17.55%	-21.602	44647	
,		. 55 <b>72.</b> 1	299 14.944	-9.080	.28424	

PAGE: 2.514

MODEL: A4D-2 LOADS INVESTIGATION LANDING

DATE

REPORT NO. 40636



REBOUND CHAMBER PRESSURE PICKUP INSTALLATION

FURM 25 9 1 (= 5.1)

PREPARED'S Meriwether, Harris
TIVLE Ldg. Loads Investigation

PAGE 2.515
MODEL A4D-2
REPORT 40636

# Air Chamber Pressure

Pressure transducers were installed to measure air pressure at the top of the orifice support tube. A photograph of the installation on the left main gear is shown on Page 2.524. The components for the air chamber pressure pickup are shown in the photograph on Page 2.525. The drawings for the pressure pickup and the special fittings are shown on Pages 2.526, 2.527, and 2.528.

PREPARED BY H. D. Meriwether
Ldg. Loads Investigation

PAGE 2.516 MODEL A4D-2 REPORT 40636

# DESCRIPTION:

This transducer measures air pressure at the top of the orifice support tube, right gear.

# CONSTANT:

PSI =  $3850 \text{ B/}\Delta$  / 50 K Ohms Res. Calib.

# CHARACTERISTICS:

# TRANSDUCER

Type - DAC Design ES 12951

Serial No. - 12A

Natural Frequency - Approx. 500 cps

# GALVANOMETER

DROP TESTS

Type - 7-339

Serial No. - 12849

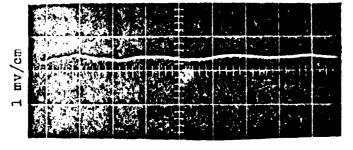
Resistance - 352.2 Ohms

Natural Frequency - 51.0 cps

Damping - 0.617

FLIGHT TESTS 7-342

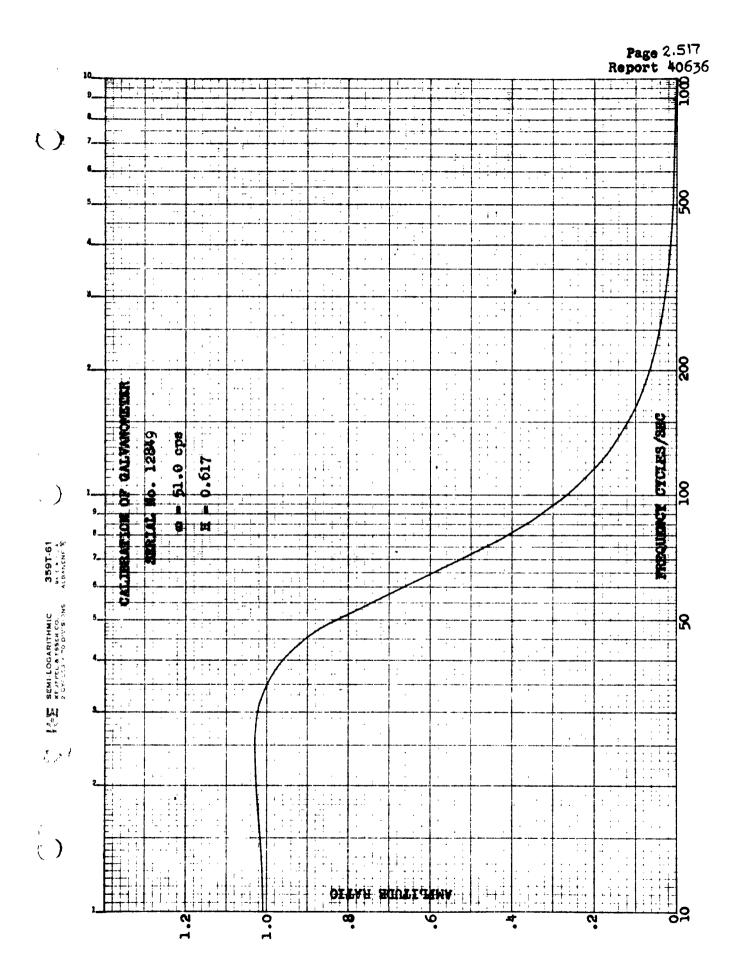
4678



.001 sec/cm

# RECORDED:

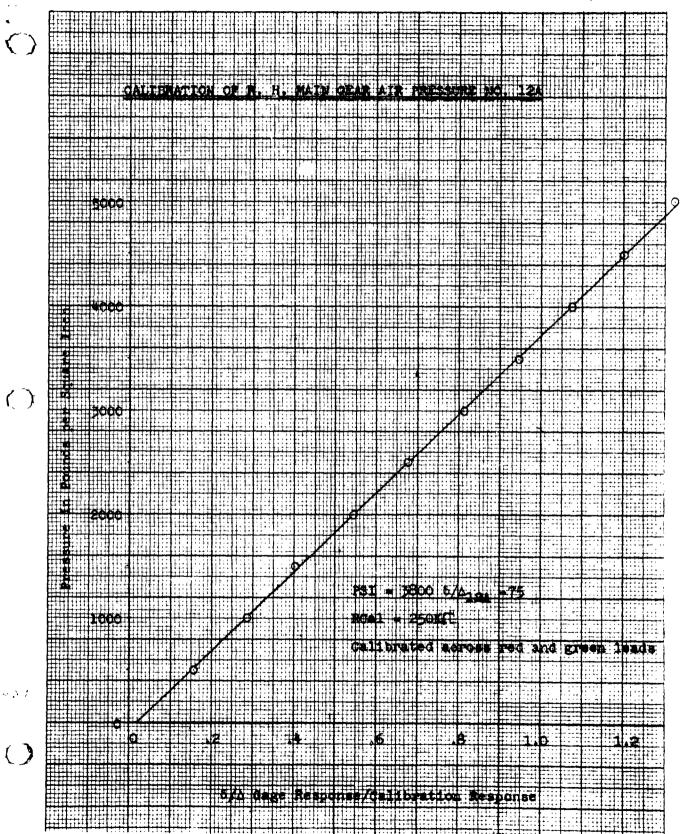
Oscillograph Channel 2-4 for Drop Test 2-34 for Flight Test



FORM 25 ms

Analysis Ldg. Loads Investigation
Propared by H. D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.

Page 2.5\8 Model A4D-2 Report No. 40636





DATE 17 Nov. 1959
PREPARED BY H. D. Meriwether
TITLE Landing Loads Investigation

PAGE 2.519
MODEL A4D-2
REPORT 40636

CONDITION

# CALIBRATION OF R. H. MAIN GEAR AIR PRESSURE PICKUP NO. 12A

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT	GAGE LOT NUMBER		CHANNEL RESPONSE IN MILLIVOLTS				
	·		PS	I = 3800	δ/Δ <sub>12A</sub>	<b>-</b> 75	
CHANNEL T	CHANNEL TITLE						
CHANNEL N	UMBER	1					
GAGE TYPE		AB-13					
GAGE REST	STANCE	350					
BRIDGE TY	PE	FULL					
GAGE FACT	OR						
BRIDGE VO	LTAGE	15 <b>v</b>					
CAL!BRATI	ON RESISTANCE	250 <b>K</b>					
CALIBRATI	ON RESPONSE	4.50	4.50				
	PSI						
ZERO	ZERO	0	0				
	500	.71	.72				
	1000	1,29	1.32		<u> </u>		
	1500	1.81	1.84				
	5000	2.45	2.45				
	2500	<u>-3.05</u>	3.04				
	3000	3.65	3.62				
	3500	4.25	4.22				
	4000	4.84	4.81				
	4500	5,41	5.38				
	5000	6.01	5.97				
RETURN ZERO	RETURN ZERU	0	0				

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PREPARED BY H. D. Meriwether
Title Ldg. Loads Investigation

PAGE 2.520 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Left Hand Strut Air Chamber Pressure Pick-up. This transducer measures the air pressure at the top of the orifice support tube. See photographs 194126 and 201344 and drawings 13868 and 13869.

# CONSTANT:

PSI =  $3942 \, \delta/\Delta + 39.7$  for 250 K Ohm Calibrating Resistor

# CHARACTERISTICS:

# TRANSDUCER

Type - DAC Drawing 12951

Serial No. - 2A

Natural Frequency - Approximately 500 cps

# GALVANOMETER

DROP TEST

1-72 73-209 .

**Type** - 7-339

7-342 7-339

Serial No. - 10398

4682 10398

FLIGHT TEST LDGS.

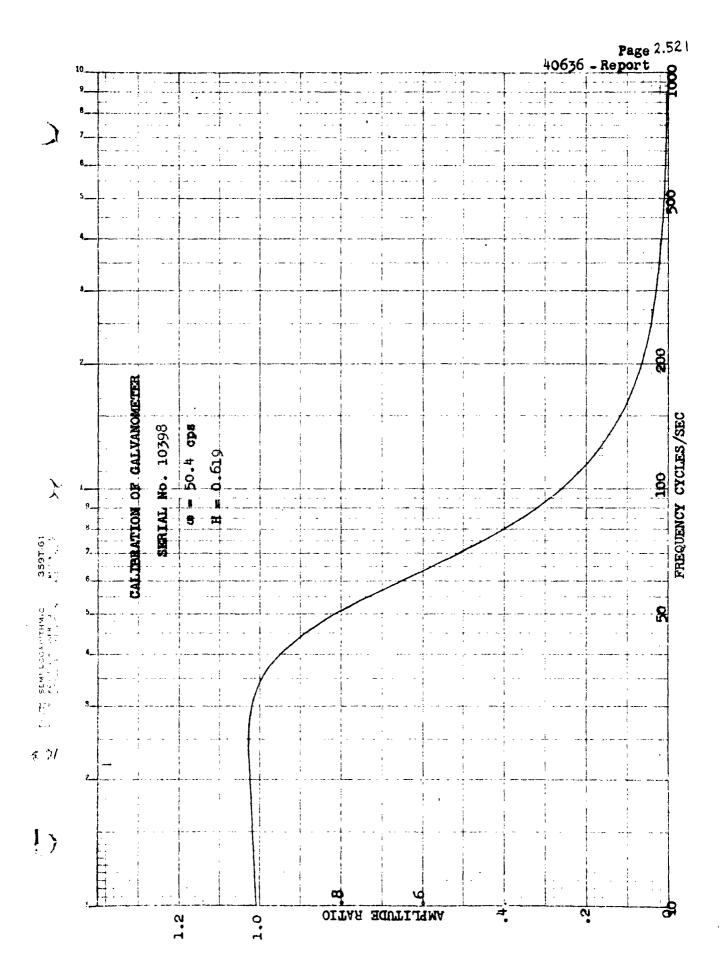
Resistance - Galvo sees 352.3 ohms

Natural Frequency - 50.4 cps

Damping - H = 0.619

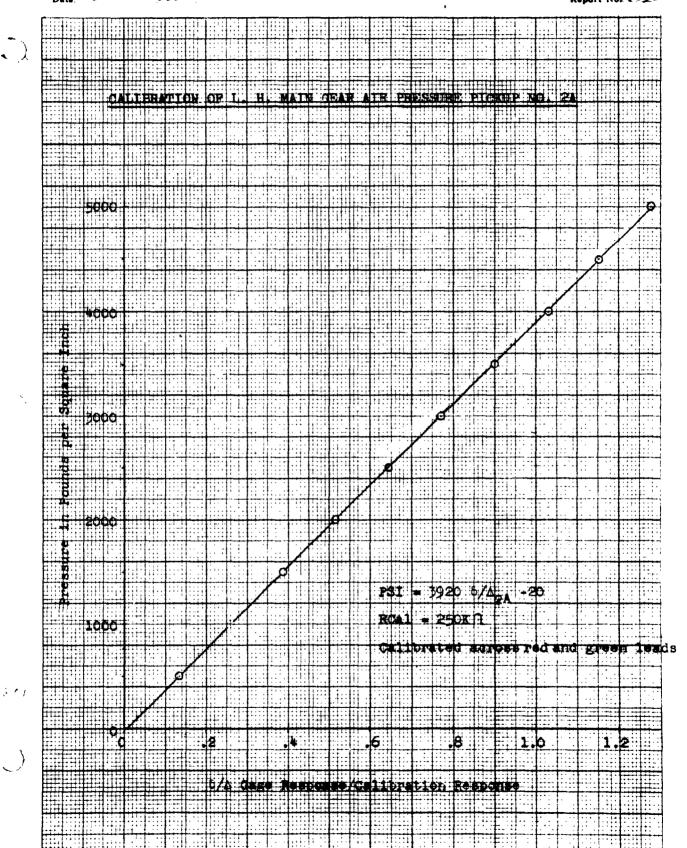
#### RECORDED:

Oscillograph Channel 2233 For Fileht Test



FORM 28 88 (5-51) Analysis Ldg. Loads Investigation
Propared by H. D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.
Date 15 Oct. 1959

Page 2.522 Model A4D-2 Report NA0636



FORM 25 5 1

# DOUGLAS AIRCRAFT COMPANY, INC.

DATE 15 Oct. 1959
PREPARED BY H. D. Meriwether
Title Landing Gear Loads Investigation

PAGE MODEL REPORT 4.5 2 3 406 3 6

CONDITION

# CALIBRATION OF L. H. MAIN GEAR AIR PRESSURE PICKUP NO. 2A

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT NUMBER		CHANGEL RESPONSE IN MILLIVOLTS					
			PS	I = 3920	δ/Δ <sub>2A</sub>	- 20	
CHANNEL TI	TLE	LHPPUA					
CHANNEL NU	MBER	1					
GAGE TYPE		AB-13					
GAGE RESIS	TANCE	350					
BRIDGE TYP	PE	FULL					
GAGE FACTO	)R						
BRIDGE VOL	TAGE	10V					
CALIBRATIC	N RESISTANCE	250K	250 <b>K</b>				
CALIBRATIC	CALIBRATION RESPONSE		3.32	3.31			
	PSI	RUN 1	RUN 2	RUN 3			
ZERO	ZERO	0	0	0			
	500	•455	.445	•450			
	1000	.860	.860	.865			
	1500	1.28	1.285	1.280			
	2000	1.71	1.71	1.71			
	2500	2,13	2.135	2.11			
	3000	2,65	2.564	2.55			
	3500	2.99	2.99	2.98			
,	4000	3.425	3.42	3.45			
	4500	3.840	3.83	3.82			
	5000	4.24	4.24	4.19			
RETURN ZERO	RETURN ZERO	0	0	0			

# /1

FORM LB25- S- 1A (3- 52)

DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 2.524

CHECKED BY:

LANDING LOADS INVESTIGATION

MODEL: <u>A4D-2</u> REPORT NO. <u>40636</u>



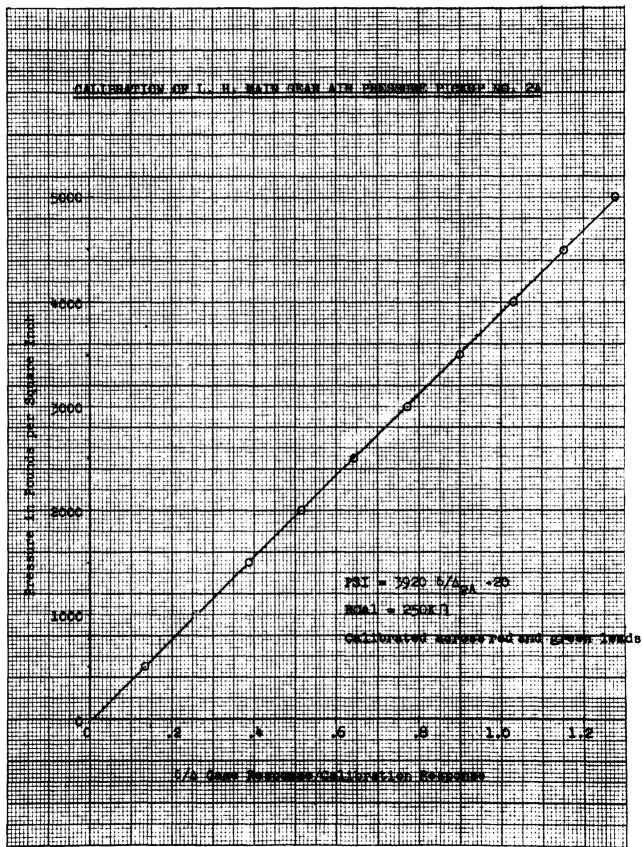
; } FORM 28 08 (5-51) Analysis Ldg. Loads Investigation

Propered by H. D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.

Date 15 Oct. 1959

Page 2.522 Model A4D-2





PORM 25-5-1

# DOUGLAS AIRCRAFT COMPANY, INC.

DATE 15 Oct. 1959
PREPARED BY H. D. Meriwether
TITLE Landing Gear Loads Investigation

PAGE 2.523 MODEL 440-2

CONDITION

# CALIBRATION OF L. H. MAIN GEAR AIR PRESSURE PICKUP NO. 2A

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT NUMBER		CHANNEL RESPONSE IN MILLIVOLTS					
			PS	I = 3920	δ/Δ <sub>2A</sub>	-20	
CHANNEL	TITLE	LHPPUA					
CHANNEL 1	NUMBER	1					
GAGE TYPE	-	AB-13					
GAGE RES	ISTANCE	350					
BRIDGE T	YPE	FULL					
GAGE FACT	TOR						
BRIDGE V	OLTAGE	10V					
CALIBRAT	ION RESISTANCE	250K	250 <b>K</b>				
CALIBRAT	ION RESPONSE	3.34	3.32	3.31			
	PSI	RUN 1	RUN 2	RUN 3			
ZERO	ZERO	0	0	0			
	500	•455	.445	.450			
	1000	.860	.860	<b>.</b> 86 <b>5</b>			
	1500	1.28	1.285	1.280			
	2000	1.71	1.71	1.71			
	2500	2.13	2.135	2.11			
	3000	2.65	2.564	2.55			
	3500	2,99	2.99	2.98			
•	4000	3.425	3.42	3.45			
	4500	3.840	3.83	3.82			
	5000	4.24	4.24	4.19			
RETURN ZERO	RETURN ZERO	0	0	0			



FORM LB25- S- 1A (3- 52)

DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 2.524

CHECKED BY:

MODEL: A4D-2 REPORT NO. 40636



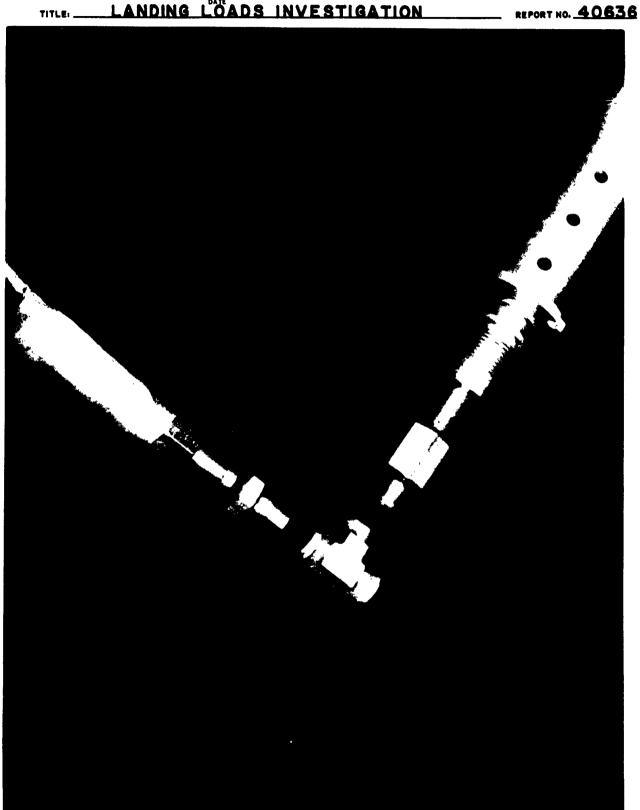
-591

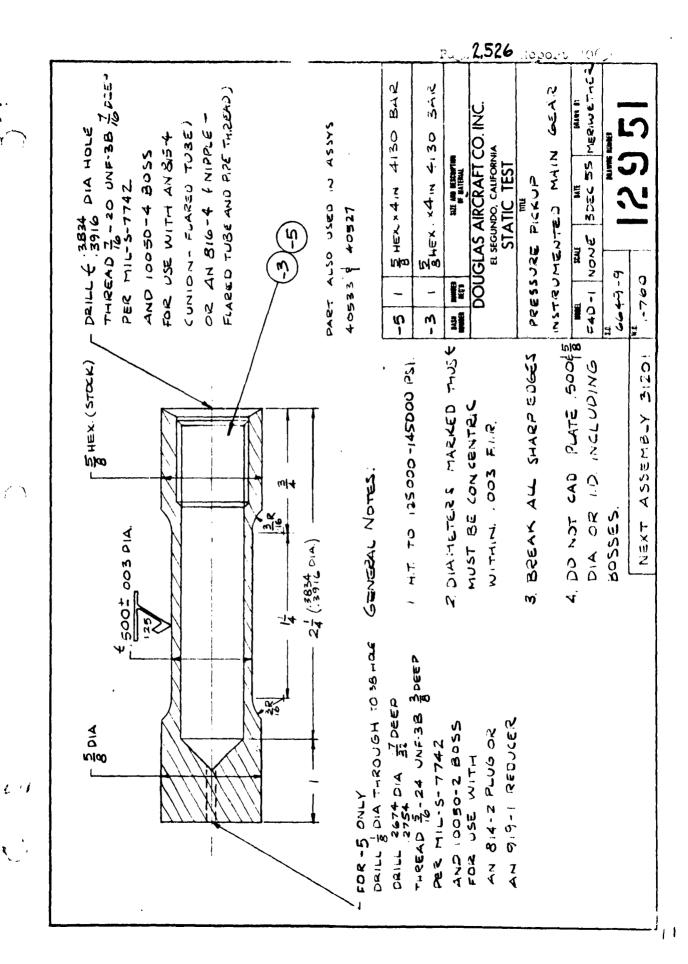
F	0 #	м	L	825	<b>S</b> -	1 A
1	٠.		21			

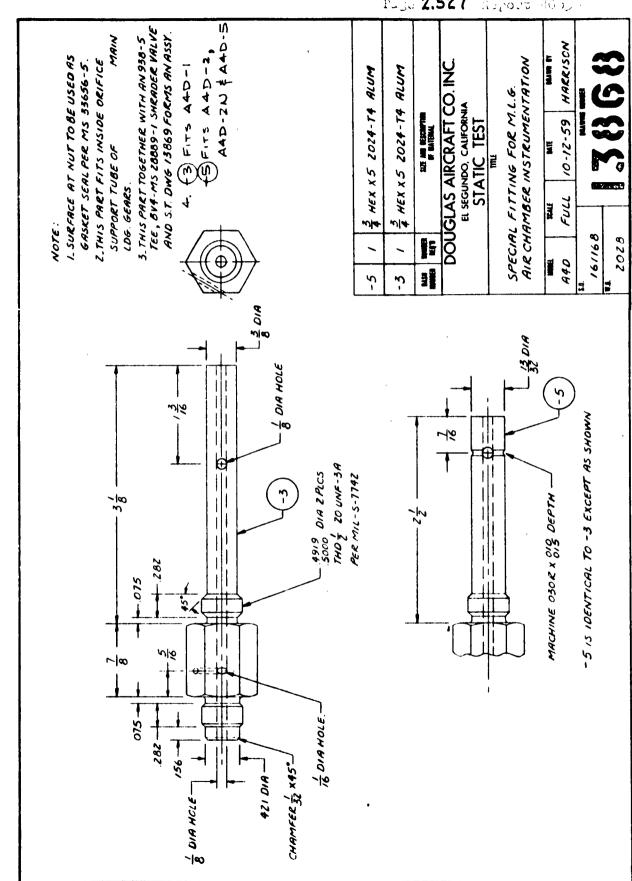
PAGE: 2.525 MODEL: A4D-2

CHECKED BY:

LANDING LOADS INVESTIGATION

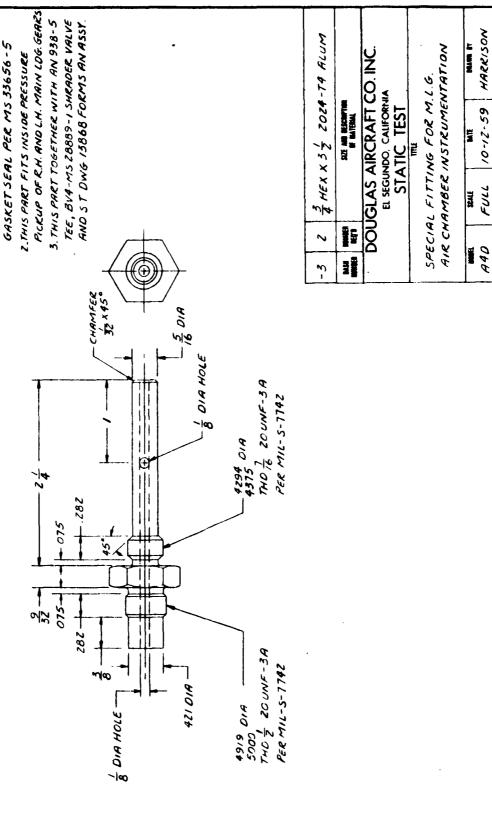






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1. SURFACE AT NUT TO BE USED AS

NOTE

FORM 25-5	1
1 4-4 2)	
4 4 17 40	

DATE	
PREPARED	ev Meriwether, Harris
TITLEI	dg. Loads Investigation

PAGE 2.601 MODEL A4D-2 REPORT 40636

# Drag Brace Axial Loads

Strain gages were placed on the main landing gear drag braces to measure tension and compression loads. A photograph of the installation on the left hand main landing gear is shown on Page 2.614.

261

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PREPARED BY H. D. Meriwether
Title Idg. Loads Investigation

PAGE 2.602 MODEL A4D-2 REPORT 40636

# DESCRIPTION:

Right hand gear drag brace. This transducer measures axial load in the right hand gear drag brace.

# CONSTANT:

Tension = 57626  $\delta/\Delta/$  50K Ohms Resistor Calibration Compression = 57638  $\delta/\Delta$  / 50K Ohms Resistor Calibration

# CHARACTERISTICS:

# TRANSDUCER

Type - ABF 13 Strain Gages

# GALVANOMETER

Type - 7-342

Serial No. - 7258

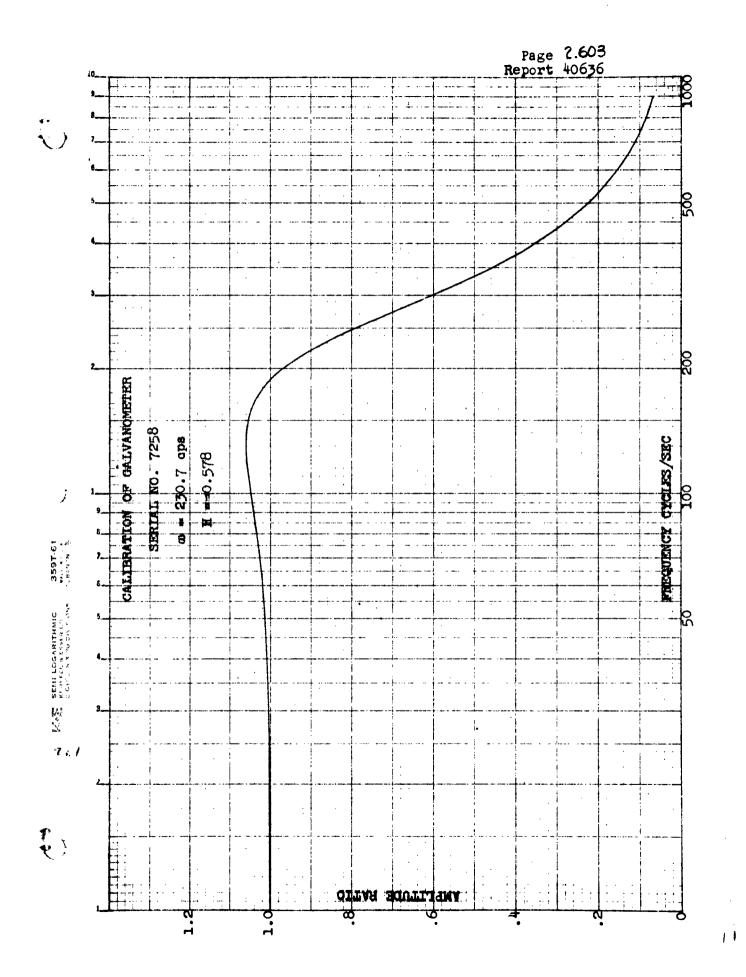
Resistance ~ 346.8 Ohms

Natural Frequency - 230.7 cps

Damping - 0.578

# RECORDED:

Oscillograph channel 2-15 for Drop Test 1-30 for Flight Test

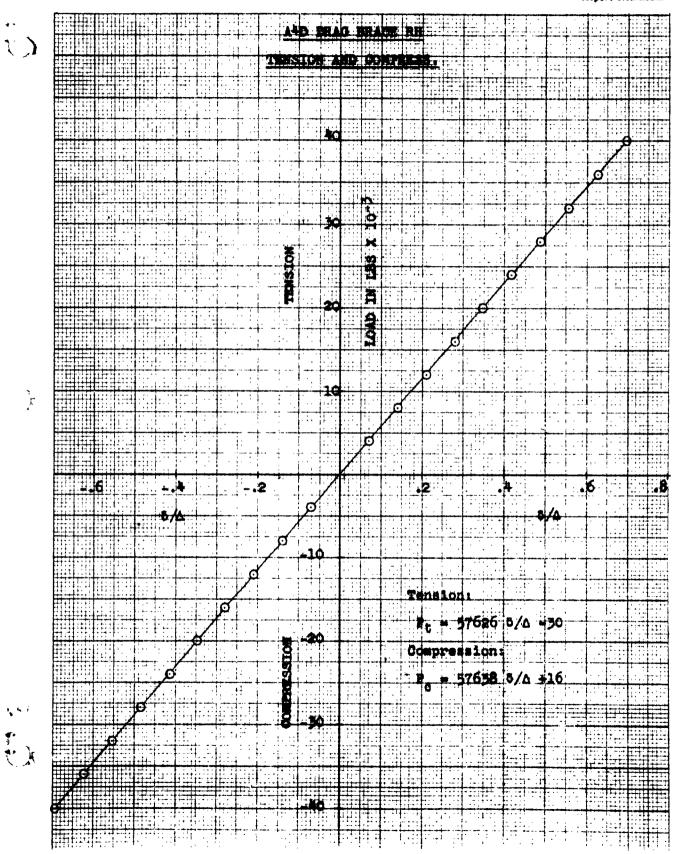


Analysis Carrier Suit, Inst.

Prepared by H. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.

Date 1-29--60

Page 2.604
Model A4D-2
Report No 40636



DATE	1-29-60
PREPARED	ev H. Meriwether
T	Carrier Suit. Inst.

MODEL 40636

CONDITION

# A4D Drag Brace RH TENSION

CALIBRATE BETWEEN RED AND GREEN LEADS

CACE LOT N	II MRED	<u> </u>	····					
GAGE LUI N	GAGE LOT NUMBER		CHANNEL RESPONSE IN MILLIVOLTS					
		$P_{t} = 57626  \delta/\Delta - 30$						
CHANNEL TI	CHANNEL TITLE							
CHANNEL NU	CHANNEL NUMBER							
GAGE TYPE	GAGE TYPE							
GAGE RESIS	GAGE RESISTANCE		350					
BRIDGE TYP	BRIDGE TYPE		Full					
GAGE FACTO	GAGE FACTOR		2.03					
BRIDGE VOL	BRIDGE VOLTAGE		6 <b>v</b>					
CALIBRATIC	CALIBRATION RESISTANCE		50 K					
CALIBRATIO	CALIBRATION RESPONSE		10.065					
		.Run 1	Run 2		δ/Δ ave			
ZERO	ZERO	0	0					
	4000	.710	.710		.070			
	8000	1.409	1.410		.140			
	12000	2.109	2.092		.209			
	16000	2.800	2.797		.278			
	20000	<b>3.</b> 499	3.493		.347			
	24000	4.192	4.190		.416			
	28000	4.902	4.900		.487			
-	32000	5.593	5.610	•	.556			
	36000	6.282	6.290		.624			
	40000	7.012	7.010		<b>.6</b> 96			
RETURN ZERO	RETURN ZERO	0	0					

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FORM 28 - 9 - 1

DC

DOUGLAS AIRCRAFT COMPANY, INC.

DATE	1-29-60		
	By H. Mar	inether	
TITLE	Carrier 5	uit. In	at.

PAGE 2.606 Model - 440-2

CONDITION

# A4D Drag Brace RH COMPRESSION

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT NUMBER		CHANNEL RESPONSE IN MILLIVOLTS					
		P <sub>G</sub> = 57638 5/4 +16					
CHANNEL TITLE		RHDB					
CHANNEL N	CHANNEL NUMBER			,			
GAGE TYPE		ABF-13					
GAGE RESI	GAGE RESISTANCE		350				
BRIDGE TY	BRIDGE TYPE		Full				
GAGE FACT	GAGE FACTOR		2.03				
BRIDGE VOLTAGE		6 <b>N</b>	6 <b>v</b>				
CALIBRATI	CALIBRATION RESISTANCE		50 K				
CALIBRATI	CALIBRATION RESPONSE		10.060				
		Runl	Run 2		d/Δ ave		
ZERO	ZERO	0	0				
- ,	-4000	725	722		072		
	-8000	-1.429	-1.430		142		
	-12000	-2.115	-2.115		210		
	-16000	-2.825	-2.817		280		
	-20000	-3.507	-3.500 .		348		
<del></del>	-24000	-4.188	-4.190		416		
<del></del>	-26000	-4.895	-4.900		487		
	-32000	-5.589	-5.582		555		
	-36000	-6.290	-6.290		625		
	-40000	-6.998	-6.999		696		
RETURN ZERO	RETURN ZERO	0	0				



FORM 86-8-1

DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY E. D. Norimether
Title Lide: Loads Investigation

PAGE 2.607 MODEL AND S REPORT 46536

# DESCRIPTION:

Left hand gear drag brace. This transducer measures axial load in the left hand gear drag brace.

# CONSTANT:

Tensien Lbs. = 56970 8/ $\Delta$  / 50 K Ohms Res. Calib. Compression Lbs. = 56777 8/ $\Delta$  / 50 K Ohms Res. Calib.

# CHARACTER ISTICS:

# TRANSDUCER

Type - ABF-13 Strain Gages

# GALVANOMETER

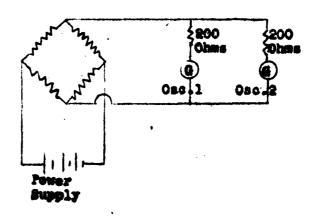
Type - 7-342

Serial No. - 7294

Resistance - 358.7 Ohms

Natural Frequency - 221.5 ops

Damping - 0.545

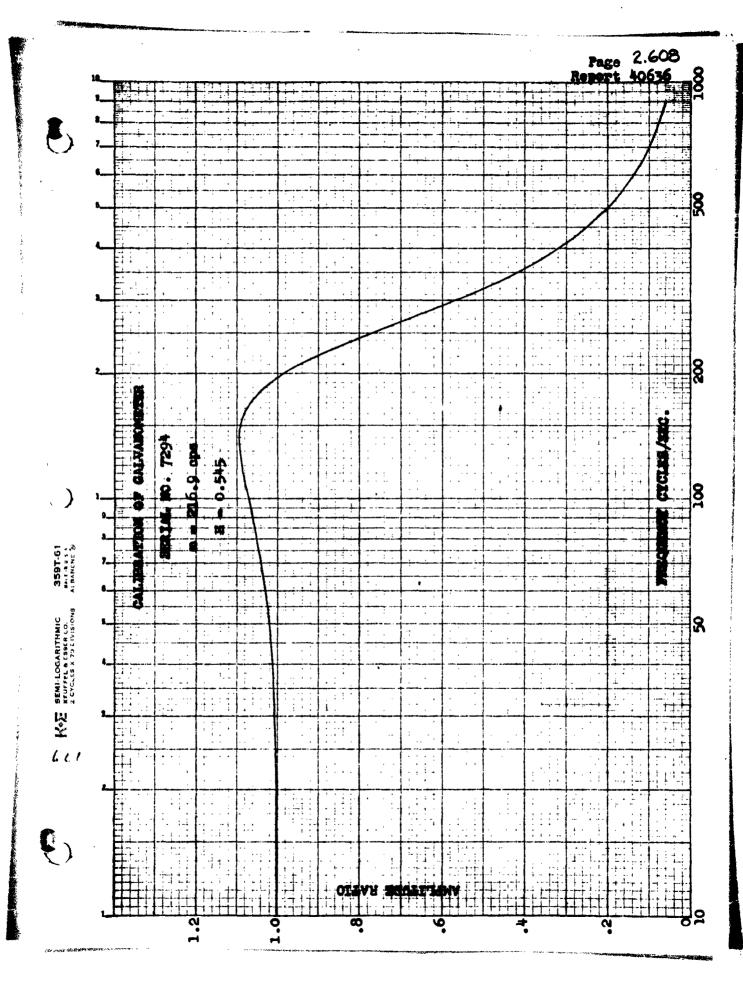


761

C

# RECORDED:

Oscillegraph Channel 1-12 for Drop Test 1-29 for Flight Test



(S+89)

Analysis Ldg. Loads Invest.

Prepared by H. Merimether DOUGLAS AIRCRAFT COMPANY, INC.

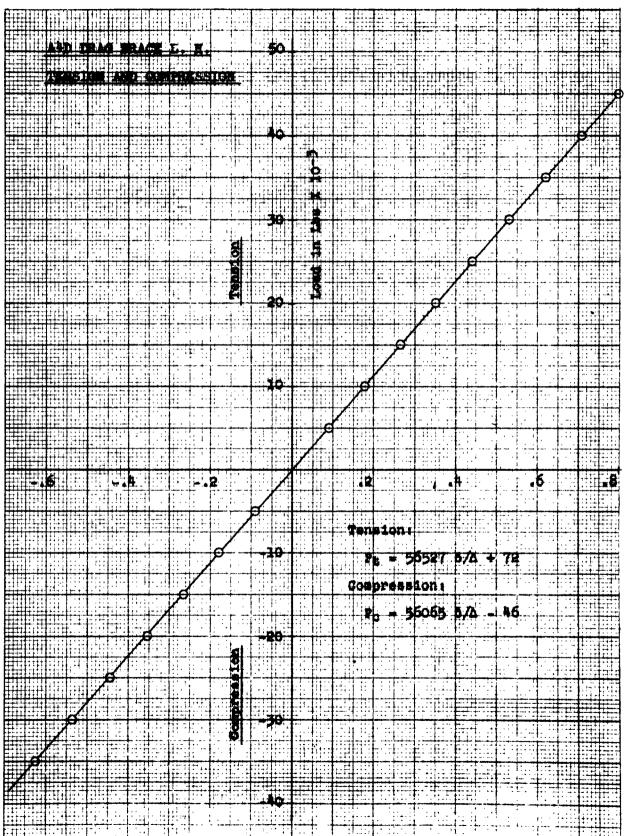
Date 7-23-59

Page 2.609

Model A4D-2

Report No. 40636





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八郎 日本山野 東京でい

FORM 28-9-1

DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY H. Meriwather
TITLE Ldg. Loads Investigation

MODEL A4D-1

(上)

CONDITION

#### A4D DRAG BRACE LH

#### TENSION

CALIBRATE BETWEEN RED AND GREEN LEADS

DWG. 22532

A40E 10T	W 1405 D				וע	10. 225	52
GAGE LOT I	NUMBER		CHANNEL	RESPONSE	IN MILLIVO	LTS	
······································		Pt = 5	6527 0/4	+ 72			
CHANNEL T	ITLE	LHDB					
CHANNEL N	UMBER	1			,		
GAGE TYPE		C-6-141					
GAGE RESI	STANCE	350	350				
BRIDGE TY	PE	Full	Full		4		
GAGE FACT	OR	2.03	2.03				
BRIDGE VO	LTAGE	10 V	10 V				
CALIBRATI	ON RESISTANCE	50 K	.50 K				
CALIBRATI	ON RESPONSE	17.87	17.76				
		RUN 1	RUN 2		5/A ave		
ZERO	ZERO	0	0				
<del></del>	5000	1.60	1.58		<b>.08</b> 9		
	10000	3.14	3.14		.176		
	15000	4.68	4.69		.263		
	20000	6.24	6.23		.350		
	25000	7.86	7.84		.440		
	30000	9.43	9.43		<b>.52</b> 9		
<del> </del>	35000	11.01	11.02		.618		
	40000	12.58	12.58		.706		
	45000	14.17	14.17		796		
	5000	15.75	15.74		.884		
RETURN ZERO	RETURN ZERO	0	0				



FORM 28 2-1

# DOUGLAS AIRCRAFT COMPANY, INC.

DATE 7-24-59

PREPARED BY H. Meriwether
TITLE Idg. Loads Investigation

PAGE 2:611 MODEL A1D-2 REPORT 40636

CONDITION

# A4D DRAG BRACE LH

# COMPRESSION

GAGE LOT	NUMBER		CHANNEL	RESPONSE	IN MILLIVOL	TS	
		Pa = 56	065 δ/Δ	-46			
CHANNEL	TITLE	LHDB					
CHANNEL	NUMBER	1					
GAGE TYP	PE .	C-6-141					
GAGE RES	SISTANCE	350	350				
BRIDGE T	TYPE	Pull	Full				
GAGE FAC	CTOR	2.03	2.03				
BRIDGE V	OLTAGE	10 V	10 V				
CALIBRAT	TION RESISTANCE	50 K	50 K			····	
CALIBRAT	TION RESPONSE	17.53	17.52				
		RUN 1	RUN 2		δ/Δave		
ZERO	ZERO	0	0				
	-5000	-1.58	-1.59		091		
	-10000	-3.17	-3.15		180		
	-15000	-4.68	-4.68		267		
	-20000	-6.24	-6.22		355		
	-25000	-7.84	-7.83		447		ļ
	-30000	-9.41	-9.41		537		<u> </u>
	-35000 -	10.98	-10.97		626		
	-40000 -	12.51	-12.51		714		
	-45000 -	-14.10	-14.08	ļ	804		
		15,63	-15,63		892		
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PREPARED BY H. D. Meriwether
Title Idg. Loads Investigation

PAGE 2.6/2 MODEL A40-2 REPORT 40636

# DESCRIPTION:

Left hand gear drag brace. This transducer measures axial load in the left hand gear drag brace.

# CONSTANT:

Tension Lbs = 57243  $\delta/\Delta$  / 50K Ohms Resistor Calibration Compression Lbs<sup>2</sup> = 56775  $\delta/\Delta$  / 50K Ohms Resistor Calibration

#### CHARACTERISTICS:

# TRANSDUCER

Type - ABF-13 Strain Gages

#### GALVANOMETER .

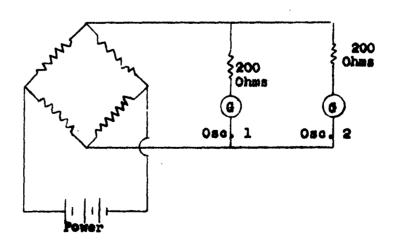
Type - 7-342

Serial No. - 4706

' Resistance - 346.8 Ohms

Natural Frequency - 230.7 cps

Damping - 0.580



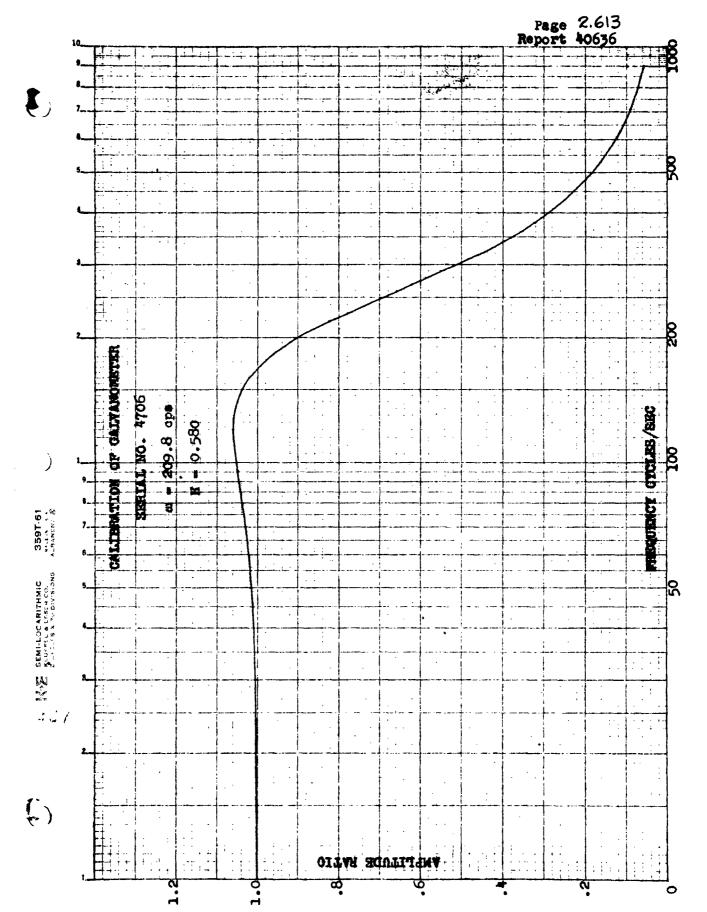
#### RECORDED:

Oscillograph channel 1-19 for Drop Test

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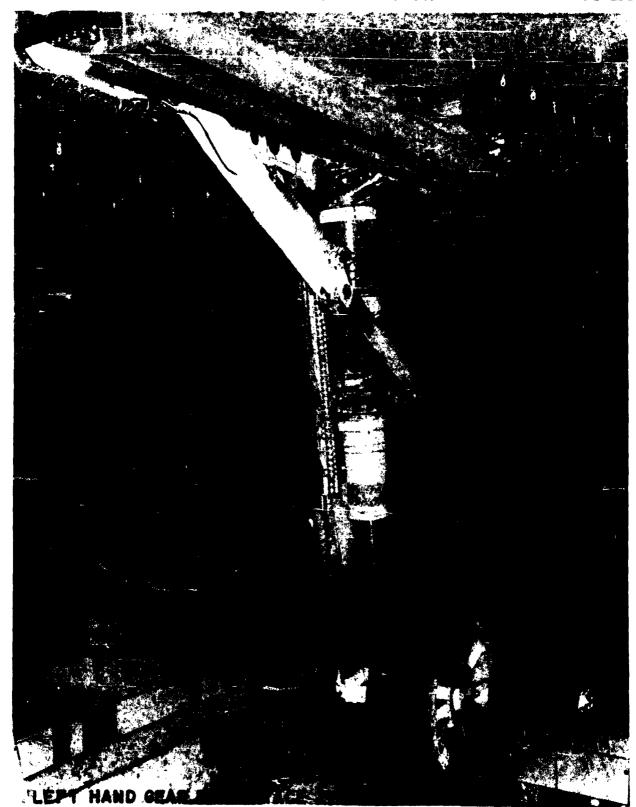
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FORM LB25- S- 1A (3- 52)

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DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BY:



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FORM 25-5-1	
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PREPARED BY Meriwether, Harris
TITLE Log, Loads Investigation

PAGE 3.001 MODEL A4D-2 REPORT 40636

# Nese Landing Gear

The nose landing gear was instrumented to measure strut position and upper mass normal acceleration.

Pages 3.001 through 3.008 discuss the strut position instrumentation. The strut position was measured with a slide wire device fabricated from drawings shown on Pages 3.005 through 3.008. A photograph of the installation appears on Page 3.004.

Pages 3.009 through 3.013 discuss the upper mass normal acceleration. A photograph of the installation is shown on Page 3.013.

19.1

PREPARED BY H. D. Meriwether
TITLE Ldg. Leads Investigation

PAGE 3.002 MODEL A4D-2' REPORT 10636

# DESCRIPTION:

Nose gear strut position. This transducer measures relative displacement between the nose gear shock strut and barrel.

# : THATEHOD

Inches =  $16.0 \, 5/\Delta$  / Pot setting (fixed)

# CHARACTERISTICS:

# TRANSDUCER

Type - DAC design ES 2621

# GALVANOMETER

Type - 7-324

Serial No. - 6225

Resistance - 78.95 Ohms

Natural Frequency - 312.5 cps

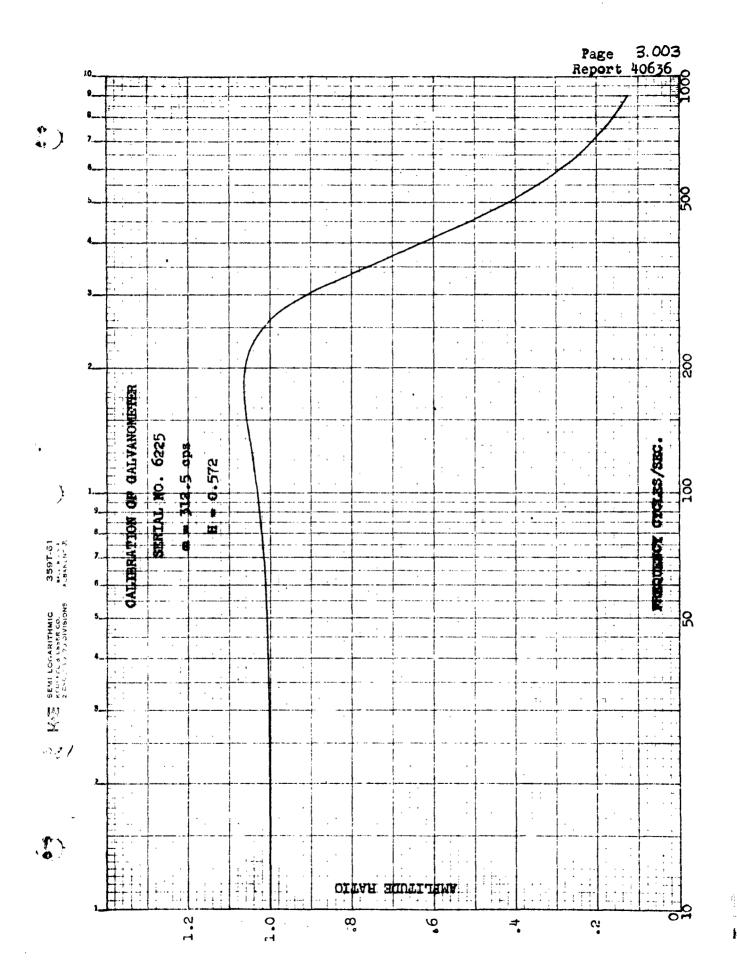
Damping - 0.572

#### RECORDED:

Oscillograph Channel 1-23 for Drop Test 2-25 for Flight Test

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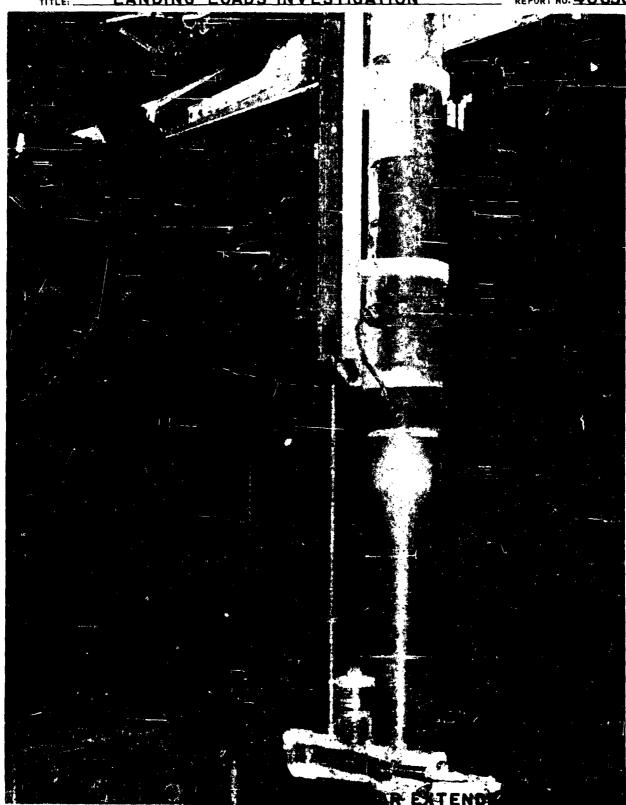
CHECKED BY:

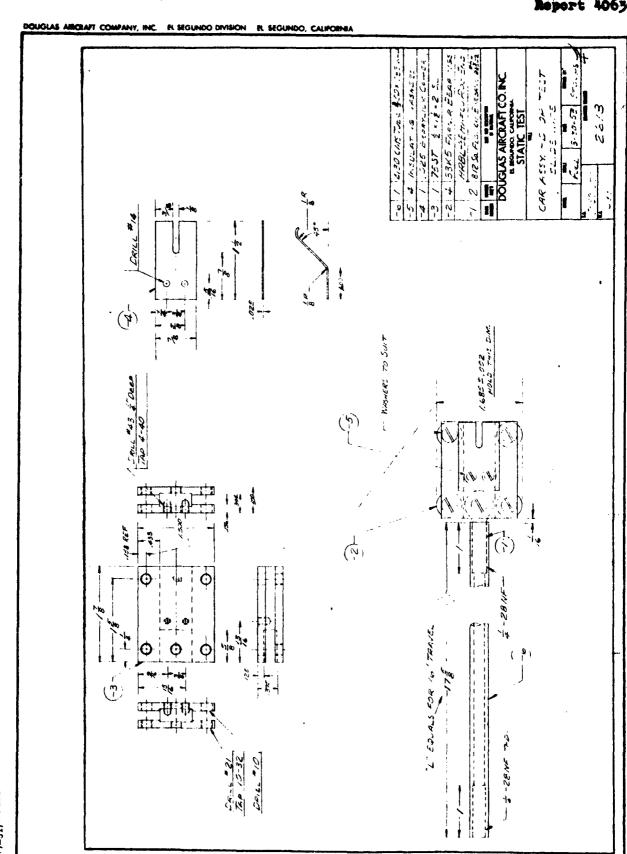
TITLE: LANDING LOADS INVESTIGATION

PAGE: 3.004

MODEL: A4D-2

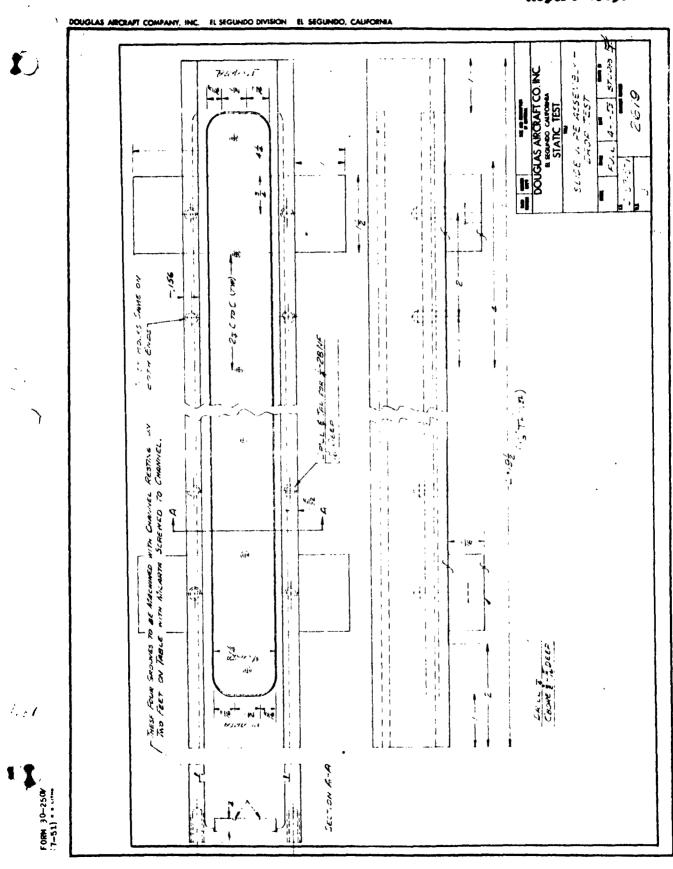
REPORT NO. 40636





FORM 30-250V

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1.01

DOUGLAS ARCRAFT COMPANY, INC. EL SEGUNDO DIVISION EL SEGUNDO, CALIFORNIA 1 24 x12 x 8 245, OR 755, FULL 4-3-53 STOOM COVER PLATES - DASP TEST SUISE WAS DOUGLAS ARCRAFT CO. INC. B. SCALOD, CALCIDEA STATIC, TEST ₩ - |--2620 Φ 1729-501 E - JRILL #28-3HOLES FRONT COVER PLATE TOP COVER PLATE  $\Theta$ (LANWAL , 91) Deil - 28 - 4 HOLES COURLY SPACED ر ښ) BOTTOM COVER PLATE (14) -- :::0

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FORM 30-250V

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FORM 30-250V

FORM 88-8-1

#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY H. D. Meriwether
THE Ldg. Loads Investigation

PAGE 3.009
MODEL A4D-2
REPORT 40636

#### DESCRIPTION:

Nose gear upper mass vertical accelerometer. This transducer measures accelerations at aircraft stations X = 0.0, Y = 127.0 and Z = -39.1.

#### CONSTANT:

 $G^{\dagger}s = 11.484 \delta/\Delta / 50 \text{ K Ohms Resis. Calib.}$  (up scale - mass up)

#### CHARACTERISTICS:

# TRANSDUCER

Type - A5A-30-350

Serial No. - 3917

Natural Frequency - 382.0 cps

Damping - 0.88

no measurable supporting structure resonance

# GALVANOMETER

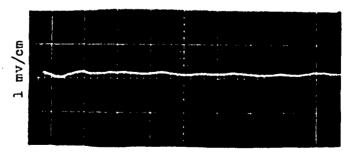
Type - 7-342

Serial No. - 4961

Resistance - 350.8

Natural Frequency - 228.4 cps

Damping - 0.600



.001 sec/cm

# RECORDED:

Oscillograph Channel 1-24 for Drop Test

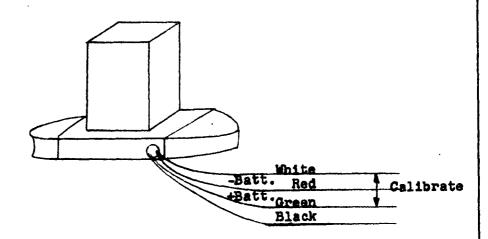
FORM 25-5-1
(3-51)
£ & L17H#

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PREPARED	ev H. Meriwether	
	dr. Loads Investigation	

PAGE 3.010 MODEL A4D-2 REPORT 40636

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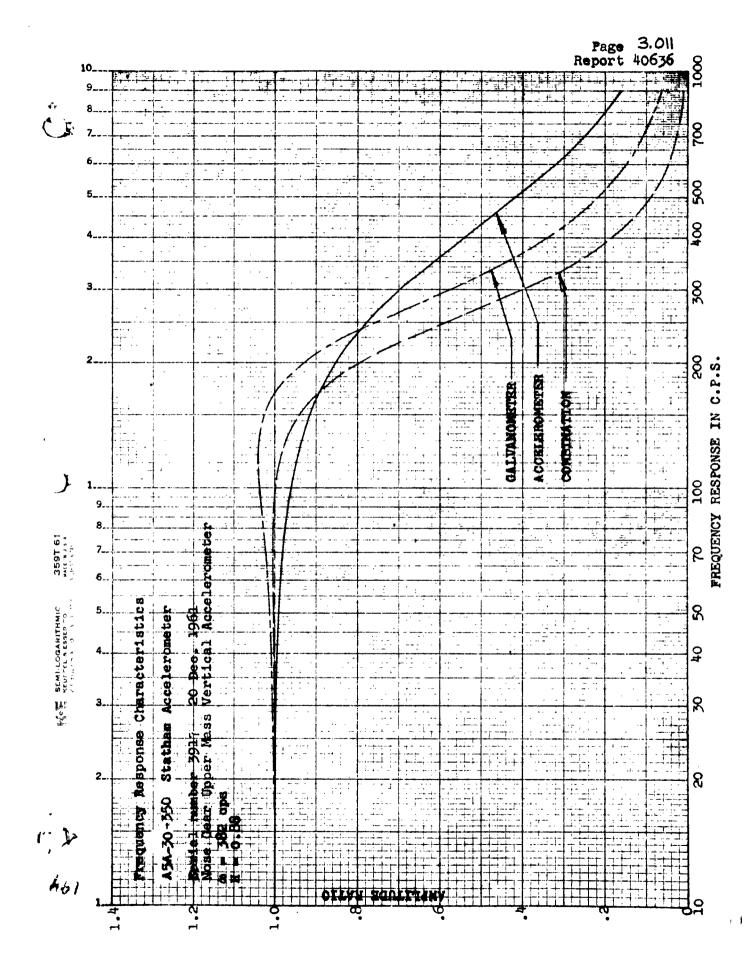
NOSE GEAR UPPER MASS VERTICAL ACCELEROMETER



Label faces barrel

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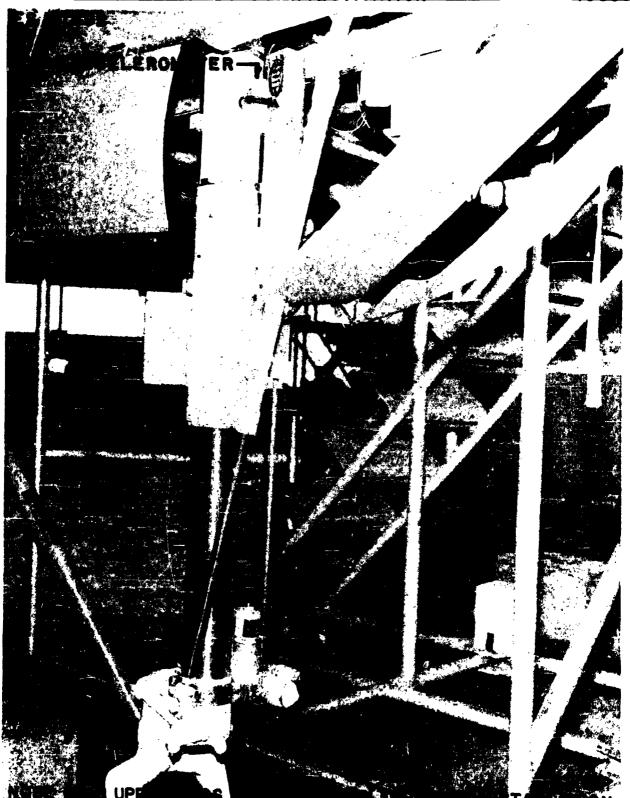
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PAGE: 3.013 MODEL: A4D-2

REPORT NO. 40636

PREPARED BY:

TITLE: LANDING LOADS INVESTIGATION



FORM 25-5 1

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DATE			
PREPARED BY	I. B.	Harris	
Time Lds			

MODEL A4D-2
REPORT 40636

# AIRPLANE CENTER OF GRAVITY

Accelerometers, an attitude gyro, and a roll rate gyro were installed at or near the airplane center of gravity to measure the vertical and longitudinal accelerations, the pitch and roll angles, and the roll rate experienced by the airplane.

# Accelerations at Center of Gravity

Pages 4.002 through 4.011 discuss the accelerometer installations. Two accelerometers were oriented to measure normal acceleration, one for low range and one for high range. A third accelerometer was installed to measure longitudinal acceleration. These accelerometers were mounted parallel and perpendicular to the fuselage reference plane. The accelerometer installations in the drop test airplane and in the flight test airplane are shown in the photographs on Pages 4.012 and 4.013, respectively.

PREPARED BY H. D. Meriwether
TITLE Ldg. Loads Investigation

MODEL 4002 REPORT 40636

FLIGHT TEST

7-342

4945

# DESCRIPTION:

C.G. normal accelerometer, low range. This transducer measures accelerations at aircraft stations X = 0.0, Y = 220.4 and Z = -26.3.

# CONSTANT:

 $Q' = .6117 \ \delta/\Delta \ / 50 \ K \ Ohms \ Resis. Calib.$ 

up scale, mass down

# CHARACTERISTICS:

#### TRANSDUCER -

Type - Statham AJ26A-1-350

Serial No. - 331

Natural Frequency - Mount 546.6 cps

Damping - Mount 0.08

#### GALVANOMETER

DROP TEST

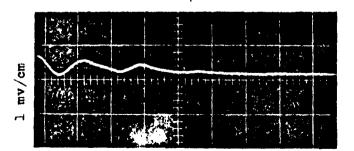
Type - 7-312

Serial No. - 5768

Resistance - 357.7 Ohms

Natural Frequency - 110.6 cps

Damping - 0.558



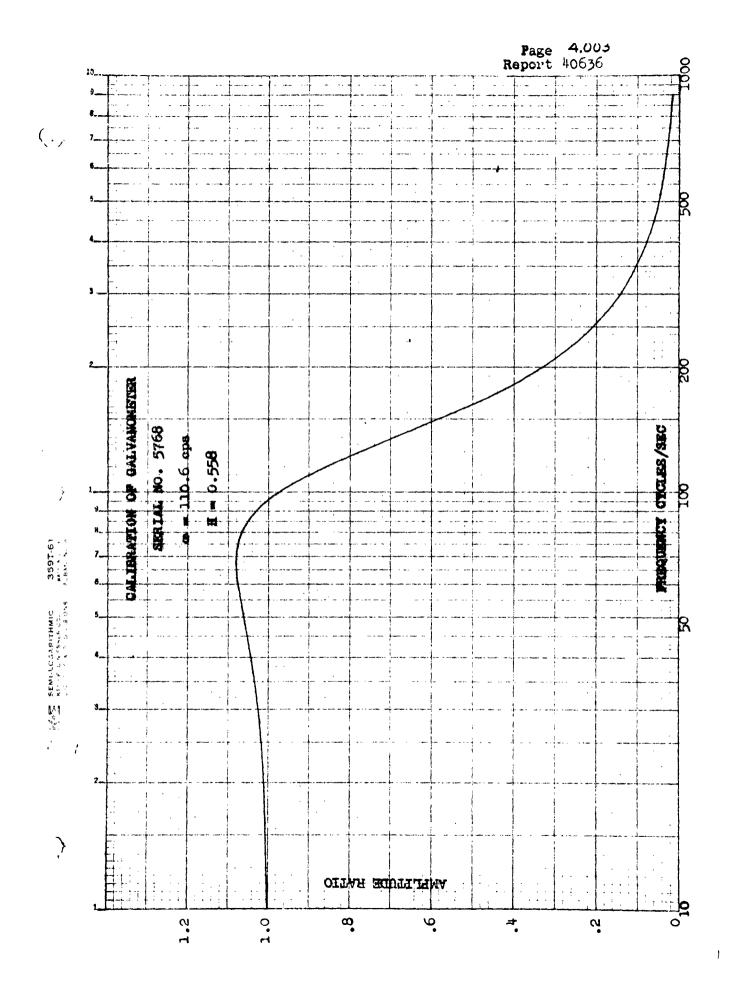
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#### RECORDED:

Oscillograph Channel 1-27 for Drop Test

301

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Pressure by H. Mariwather
Time Idg. Loads Investigation

Model 4005 Report 40636

#### DESCRIPTION:

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10 G C.G. normal accelerometer. This transducer measures accelerations at aircraft stations X=0.0, Y=221.3, Z=-21.6.

# CONSTANT:

 $G's = 7.86 \frac{S}{\Delta}$  /50 K Ohms Resis. Calib. Up scale, mass down

#### CHARACTERISTICS:

# TRANSDUCER

Type - Statham AJ43A-10-350

Serial No. - 728

Natural Frequency - 120.0 cps no mount resonance noticeable

Damping - 0.78

# GALVANOMETER

Type - 7-342

Serial No. - 4973

Resistance - 357.7 Ohms

Natural Frequency - 218.9 cps

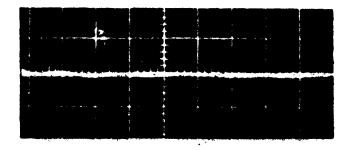
Damping - 0.601

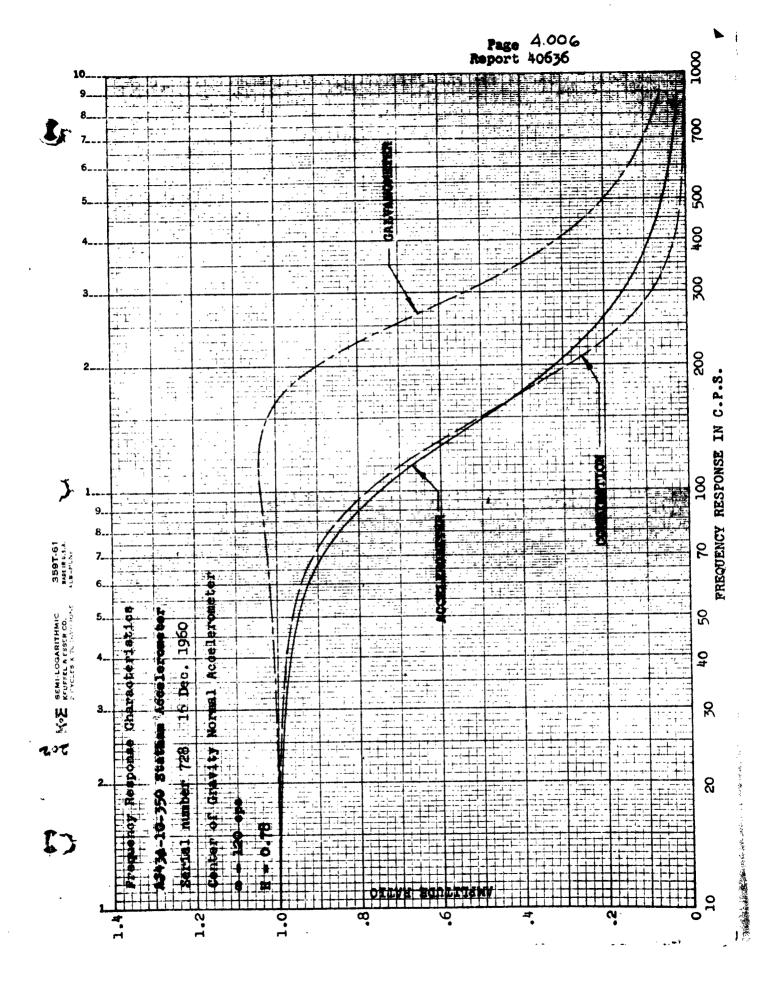
#### RECORDED:

Oscillograph Channel 1-31 for Drop Test 2-13 for Flight Test

MV/CM

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Ant 25 . 1	DOUGLAS AIRCRAFT COMPANY, INC.
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1	Page 4.008 Report 40636
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PREPARED BY H. Meriwether TITLE LOSS LOSS TOWERS Loads Investigation

#### DESCRIPTION:

C.G. longitudinal accelerometer. This transducer measures accelerations at aircraft stations X = 0.0, Y = 221.4, Z = -22.1.

# CONSTANT:

 $Q's = .5488 \frac{5}{\Delta}$  /50 K Ohms Resis. Calib. Up scale, mass aft

# CHARACTERISTICS:

# TRANSDUCER

Type - Statham D-06-350

Serial No. - 4

Natural Frequency - Mount 494.8 cps

Damping - Mount 0.015

# GALVANOMETER

Type - 7-312

Serial No. - 8097

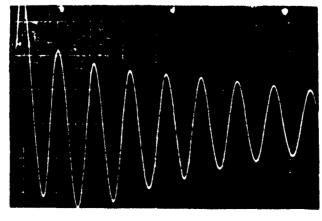
Resistance - 364.9 Ohms

Natural Frequency - 106.9 cps

Damping - 0.523

# RECORDED:

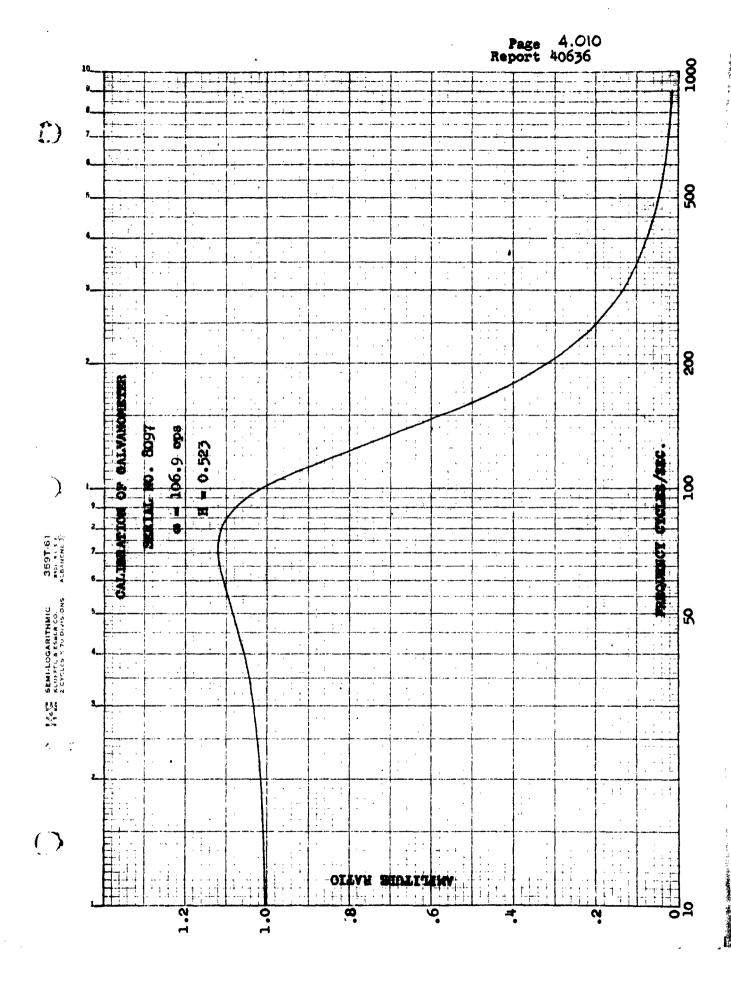
Oscillograph Channel 1-29 for Drop Test



0.005 SEC/CM

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PREPARED BY I. E. Harris
TITLE Ldg. Loads Investigation

PAGE 4.011
MODEL A4D-2
PROPEY 40636

P

# DESCRIPTION:

Measures longitudinal acceleration at airplane center of gravity.

# CONSTANT:

0.573 0's/50 K

#### CHARACTERISTICS:

# TRANSDUCER

Type

Statham AJ26-1-350

Serial No. 420

# GALVANOMETER

Type

CEC 7-342

Serial No. 5033

# RECORDED:

Oscillograph Channel 2-12 for Flight Test

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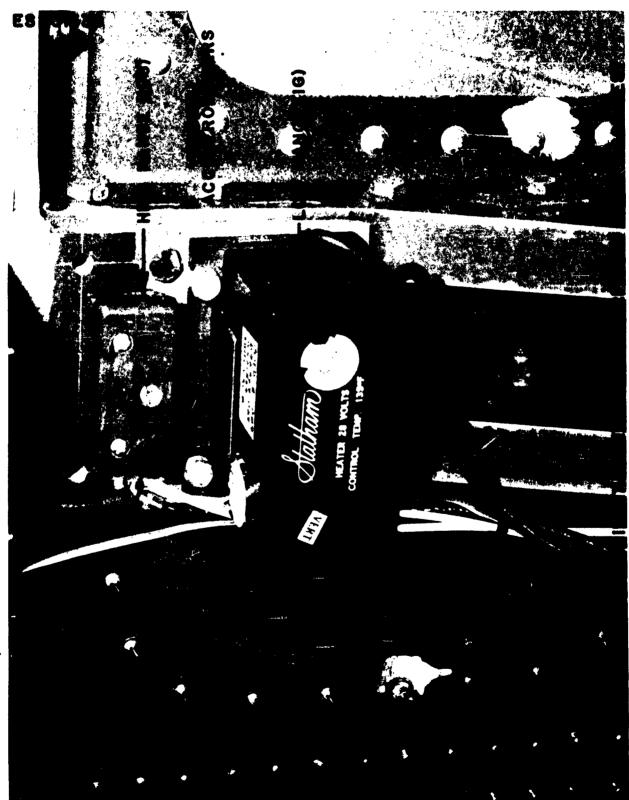
PREPARED BY:

DATE

LANDING LOADS INVESTIGATION

PAGE: 4.012

REPORT NO. 40636



305

FURM	L B25	5	1.4	

PAGE: 4.013

MODEL: A4D-2 REPORT NO. 40636

LANDING LOADS INVESTIGATION

FORM 25-5-1 1 5-511 6 5 LITES

DATE PREPARED BY I. E. Harris
Title Idg. Loads Investigation

PAGE 4.101 MODEL 490-2 PEROPY 49636

# Airplane Pitch and Roll Angles

Pages 4.102 through 4.119 discuss the attitude gyro installation used to measure airplane pitch and roll angles. The installations in the drop test airplane and in the flight test airplane are shown in the photographs on Pages 4.123 and 4.124.

# Airplane Rate of Roll

Pages 4.120 through 4.122 discuss the rate of rell gyro installation. The rate of rell gyro was installed for the flight test phase only. A photograph of the installation appears on Page 4.124.

PREPARED BY H. D. Neriwether
Time Ide. Loads Investigation

MODEL 40036

#### DESCRIPTION:

Aircraft pitch attitude. This transducer measures aircraft fuselage reference line pitch angle with respect to the horisontal.

#### CONSTANT:

Degrees = 3.534  $\delta/\Delta$  / 500K Ohms Resistor Calibration

# CHARACTERISTICS:

# TRANSDUCER

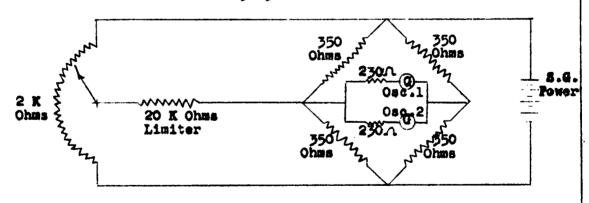
Type - Gyro DJG 7044A62

Serial No. - N4083

#### GALVANOMETER

Type - 7-339

Serial No. - 13213



# RECORDED:

1 4 7

Oscillograph Channel 2-28 for Drep Test

# DOUGLAS AIRCRAFT COMPANY.INC. EL SEGUNDO DIVISIO (

PREPARED BY H.D. MERIWETHER DATE 14MAR 61 TITLE LANDING LOADS INVESTIGATION

MCCFL A4D-2 REPORT NO. 40636

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## GOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

PREPARED BY H.D. MCRIWLTHCR DATE NUMBER 61 TITLE LANDING LOADS INVESTIGATION

MODEL AND-2 REPORT NO. 40636

## CALIBRATION OF PITCH GYRC

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C

PREPARED BY H. Meriwether
Title Ldg. Loads Investigation

PAGE 4.105 MODEL 490-2 REPORT 40636

#### DESCRIPTION:

Aircraft pitch attitude gyro.

## CONSTANT:

Degrees =  $3.595 \text{ } \delta/\Delta$  / 500 K Ohms Resis. Calib.

Drop 8, Degrees =  $2.26 \text{ } 8/\Delta$  / 500 K Ohms Resis. Calib.

## CHARACTERISTICS:

## TRANSDUCER

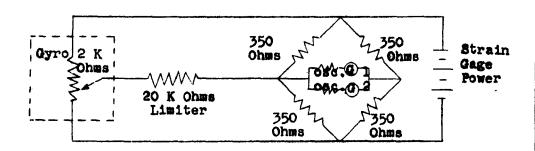
Type - D JG 7044A62

Serial No. - N 4083

## GALVANOMETER

**Type - 7-339** 

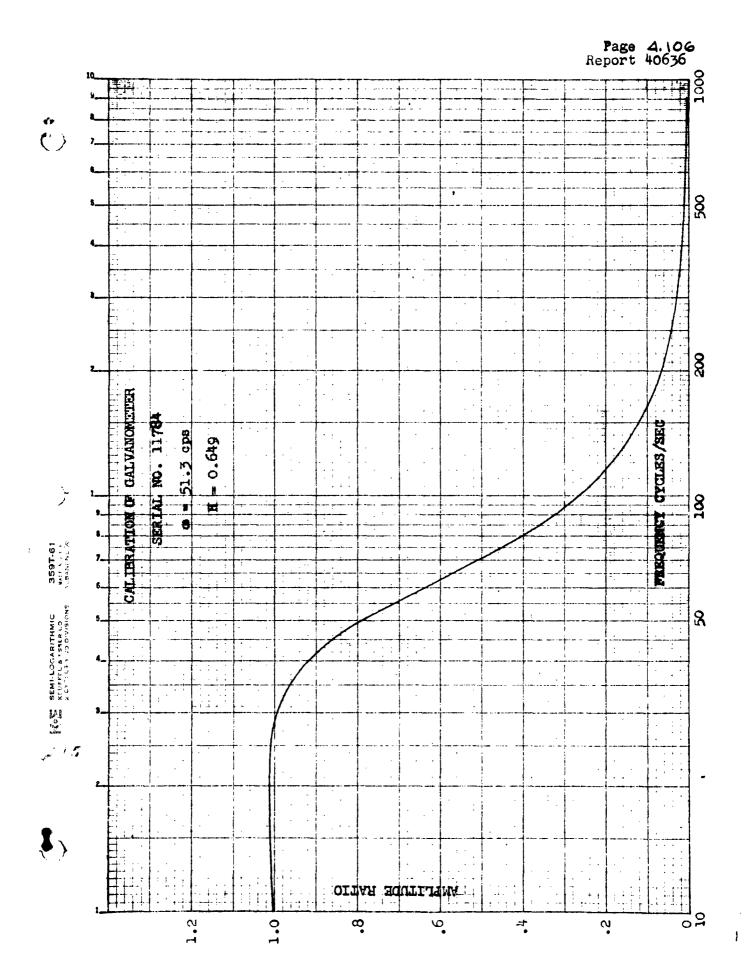
Serial No. - 11784



## RECORDED:

Oscillograph Channel 1-28 for Drop Test

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## DOMGLAS AIRCRAFT COMPANY.INC. LL SESUNDO DIVISION

PREPARED BY H.O. MERIMETHER
DATE 14MAK 61
TITLE LANDING LOADS INVESTIGATION

MODEL AND-2 REPORT NO. 49636

## CALIBRATION OF PITCH SYRO

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# LOUGEAS AIRCRAFT COMPANY, INC. SE SECUNDO DIVISION

PREPARED BY H.D. MERIWETHIR CATE 14MAR 61 TITLE LANGING LOADS INVESTIGATION

MODEL AND-2 REPORT NO. 40636

## CALIBRATICH OF PITCH GYRD

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FORM 25 - 5 1 4 1- 5 11

DATE ... PREPARED BY I.E. Harris TITLE Ldg. Loads Investigation PAGE MODEL REPORT

## DESCRIPTION:

Measures airplane attitude angle, airplane fuselage reference line with respect to a horizontal plane.

## CONSTANT:

5.20 deg/500 K Landings 1 through 72

5.16 deg/500 K Landings 73 through 209

#### DESCRIPTION:

## TRANSDUCER

Type

DJG 7044A62

Serial No. 1873 Landings 1 through 72 Landings 73 through 209

#### GALVANOMETER

Type

CEC 7-339

Serial No. 11784

## RECORDED:

Oscillograph Channel 2-10 for Flight Test

DOUGLAS AIRCRAFT COMPANY, INC. PREPARED BY: TEHARRIS CHECKED BY: LANDING LOADS INVESTIGATION 315 

DOUGLAS AIRCRAFT COMPANY, INC. PREPARED BY: I.P. HARRIS DIVISION REPORT NO.: 40436 LANDING LOADS INVESTIGATION 177

AND CARACITA AT ALLES TO THE PLAT SEVERA SOUTH THE PROPERTY OF

DOUGLAS AIRCRAFT COMPANY, INC. PREPARED BY: I.E. HARRIS A4D-2 FORM 25 RE DIVISION CHECKED BY:\_ (REV. 3-64) 40636 TITLE: LANDING LOADS INVESTIGATION TALLARA TON S/ Vosa WANTER CHAP 17,276 14 60 CAR CHE AND THOUGHT AND CONTROL OF THE CONTROL OF T CAL PAR - 103 TIME CAL PUR FOUNT SUB PRODU } A TUCK AND ALBANENE 1844. 102 ()

PREPARED BY H. Meriwether
Title Ldg. Loads Investigation

PAGE 4.113 MODEL A4D-2 REPORT 40636

## DESCRIPTION:

Aircraft roll attitude gyro.

## CONSTANT:

Degrees =  $11.09 \, 6/\Delta / 500 \, \text{K}$  Ohms Resis. Calib.

## CHARACTERISTICS:

## TRANSDUCER

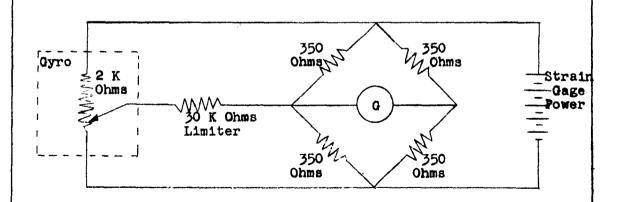
Type - DJG 7044 A 62

Serial No. - N 4083

## GALVANOMETER:

Type - 7-339

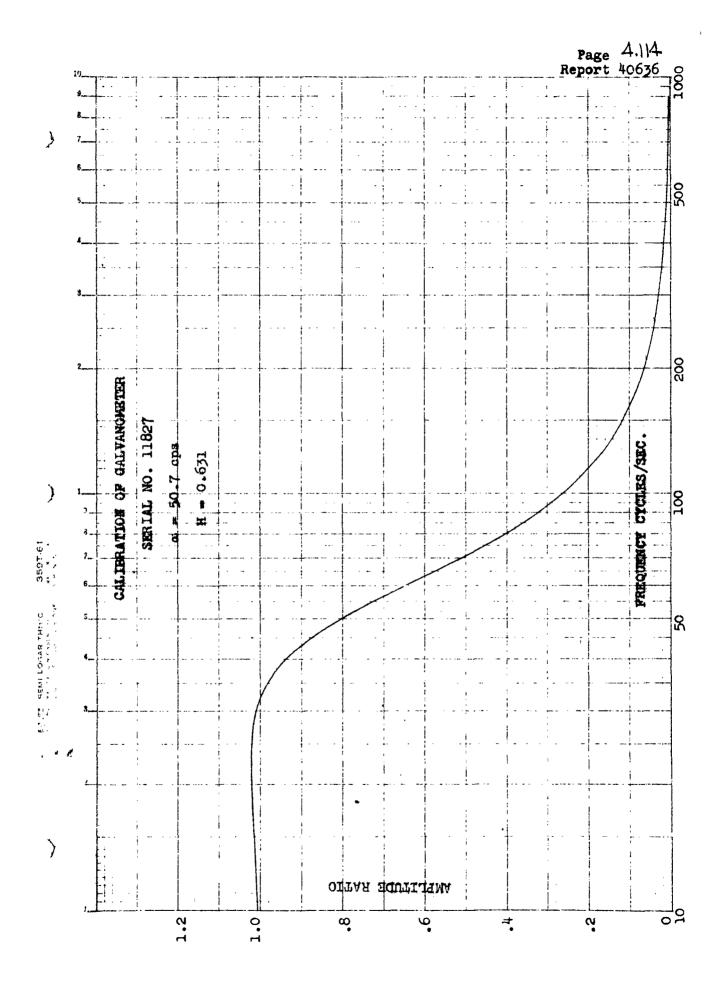
Serial No. - 11827



#### 227

## RECORDED:

Oscillograph Channel 1-30 fer Drop Test



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FORM 25 - 5 - 1 4 5- 5 1) 6 5 11700

PREPARED BY I. R. Harris TITLE Idg. Leads Investigation

## DESCRIPTION:

Measures airplane roll attitude.

## CONSTANTS:

7.16 deg/500 K Landings 1 through 72

10.95 deg/500 K L ndings 73 through 209

## CHARACTERISTICS:

## TRANSDUCER

Type

DJG 7044 A62

1873 Landings 1 through 72 4083 Landings 73 through 209 Serial No.

## GALVANOMETER

Type

CEC 7-339

Serial No.

11827

## RECORDED:

Oscillograph Channel 2-9 for Flight Test

DOUGLAS AIRCRAFT COMPANY, INC. PREPARED BY: TENARES 8-81-60 And dry was the property of the state of the Published And State of the Stat Transcript of the state of the MEANERE 1801. Ψ 365 ( ) 

DOUGLAS AIRCRAFT COMPANY, INC. 4.118 A4D-2 DIVISION 40636 Karuk ckea X. Zust de 2

4.119 DOUGLAS AIRCRAFT COMPANY, INC. PREPARED BY: I.E. HARRYS A4D-2 CHECKED BY:... 40636 TITLE: LANDING LOADS INVESTIGATION 200 20 BOLL 2000 CALLEGE CONTROL OF PROPERTY OF THE PROPERTY OF EN EN ENDER DE LE PROPERTIE

PREPARED BY I.E. Harris
TITLE Idg. Leads Investigation

MODEL 4.120
MODEL 44D=2
REPORT 40636

## DESCRIPTION:

Measures airplane rolling velecity.

#### CONSTANT:

31.3 deg/sec/50 K

## CHARACTERISTICS:

## TRANSDUCER

Туре

JU7005A-7 Rate Gyro

Serial No. 4425

## GALVANOMETER

Type

CEC 7-315

Serial No. 9562

## RECORDED:

Oscillograph Channel 2-20 for Flight Test (Not recorded for the drop test phase)

635

DOUGLAS AIRCRAFT COMPANY, INC. 4.121 PREPARED BY I E. HARRIS FORM 23 63 (ALV. 3 54) A4D-2 TITLE LOG LUADS INVESTIGATION

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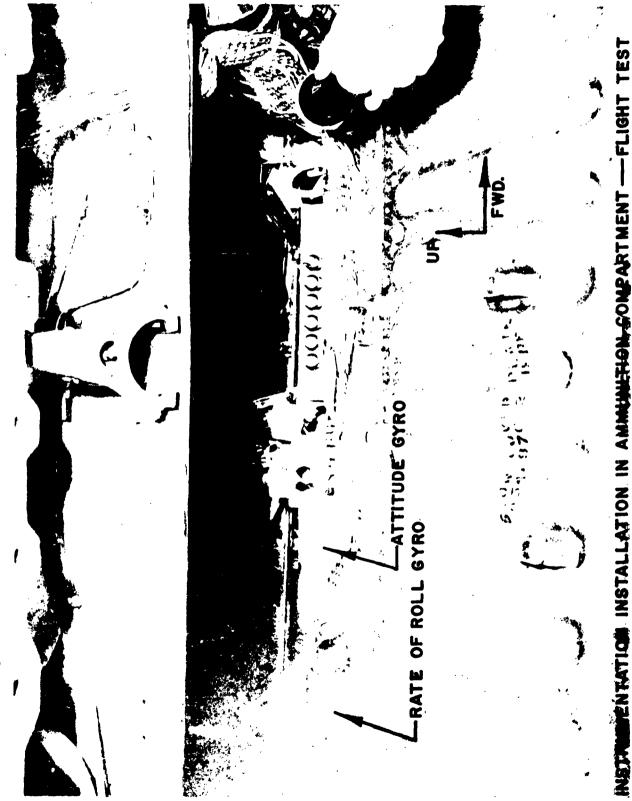
PREPARED BY

CHECKED BY-

MODEL A4D-2

REPORT NO. 40636

LANDING LÖADS INVESTIGATION



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PREPARED BY Meriwether, Harris TITLE Idg. Loads Investigation PAGE 5.001 MODEL A4D-2 REPORT 40636

## Wing Tip Accelerations

Acceleremeters were installed in each wing tip on the closing rib of the structure to measure normal acceleration. Photographs of the installations appear on Pages 5.010 and 5.011 as installed for the drop test phase and on Pages 5.012 and 5.013 as installed for the flight test phase of the program,

Lit

PREPARED BY H. D. Meriwether
TITLE Ldg. Loads Investigation

PAGE 5.00?

MODEL A/10-2

REPORT 40036

#### DESCRIPTION:

Right hand wing tip accelerometer. This transducer measures vertical accelerations in a plane perpendicular to the fuselage reference line. Accelerometer located at X = 151.4, Y = 303.3, and Z = -24.1.

## CONSTANT:

 $G's = 38.07 \frac{\delta}{\Delta}$  (up scale, mass down)

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham A6A-50-350

Serial No. - 2642

Natural Frequency - Accl. = 245.0; Mount - many, but predominant at 135 and 170 cps.

Damping - 0.68

## GALVANOMETER

Type -7-342

Serial No. - 7328

Resistance - 335.3 Ohms

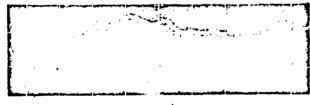
Natural Frequency - 226.5 cps

Damping - 0.607

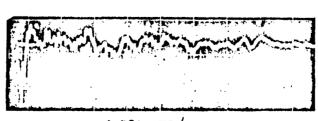
#### RECORDED:

MV/VM

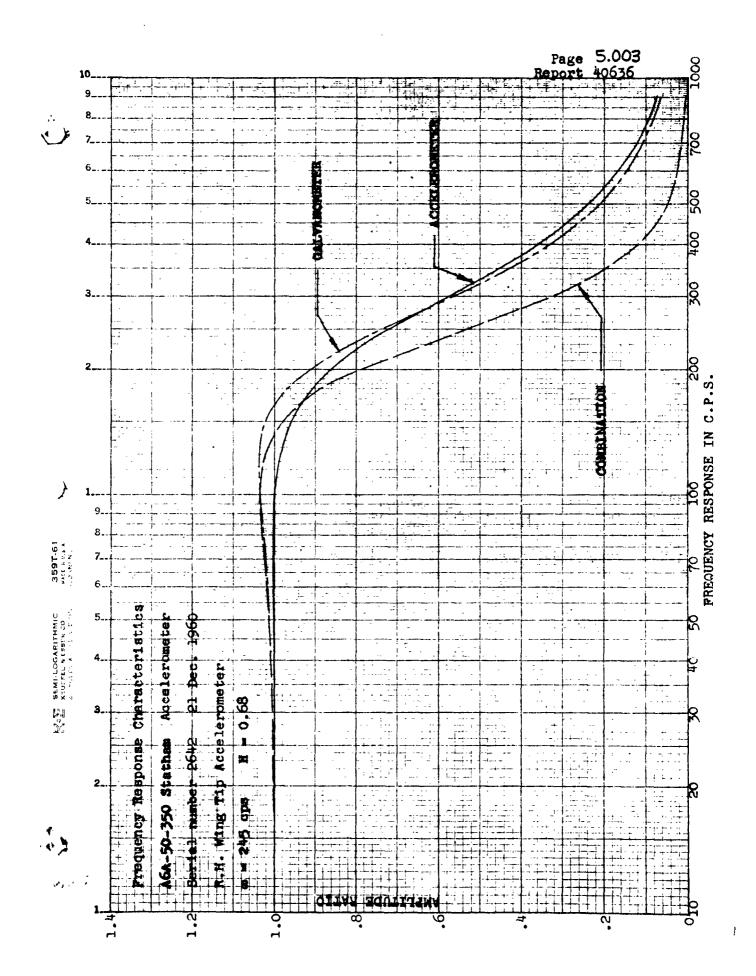
Oscillograph Channel 2-26 for Drop Test 1-28 for Flight Test



0.001 SEC/CM



0.001 SEC/CM



13-1521	DOUGLAS AIRCRAFT COMPANY, INC. 5.004
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	Page 5.004 Report 40636
+ + + + +	
	IRAISDUCER CALIDICATION SENTAL 12642
	CALIBRATION AFTER FLIGHT TEST PHISE Welleve 641049
<u> </u>	PLAIE A4D089
	TRANSDUCER DESCRIPTION STHM A64-50-350 ACCL. PR 0.68 PROGHAM E004
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	PERCENT UNBALANCE
	CHANNEL NUMBER Da
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	G2-1P •38705 02
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REPARED BY: I. E. HAPPIS DOUGLAS AIRCRAFT COMPANY, INC.

 PAGE: 5.005

REPORT NO. 48636

## TRANSDUCER CALIBRATION

Page **5.005**Report 40636
SERIAL 2642
TAG 211
D.R.O. 670464
PLANE A4D-2N

PROGRAM E004

R. Miller

ANALYST

ENGO.

CALIBRATION DATE .....05/11/60

VOLTAGE CALIBRATION FACTORS SHUNT CALIBRATION FACTORS

RMS INTERCEPT -.65203 02 G S G2-CP .36715 02

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10560	02	64550	.00	•66	39785	-01	04	•30286	00
₹00000	-39	74043	00	<b>476</b>	95850	-01	-410	.32229	00
.10560	02	61467	00	•63	-435766	-01	04	.28945	00
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.30260	02	.66217	00	•68	81184	-01	08	.29049	00
•39070	02	19147	00	20	48184	00	49	33665	00
•49000	02	10634	01	-1.09	10634	01	-1.09	10634	01

18 NAY 1960

366

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PREPARED BY H. D. Meriwether
TITLE Ide. Loads Investigation

PAGE 5.006 Model 440-2 40636

## DESCRIPTION:

Left hand wing tip accelerometer. This transducer measures vertical accelerations in a plane perpendicular to the fuselage reference line. The accelerometer location is X = -151.4, Y = 302.0, Z = -24.1.

## CONSTANT:

0's = 37.47  $\delta/\Delta$  (up scale, mass down)

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham A6A-50-350

Serial No. - 2648

Natural Frequency - Accel., 302 cps; Mount - many, but predominant at 820 cps with damping of 0.108

Damping - 0.53

#### GALVANOMETER

Type -7-342

Serial No. - 7343

Resistance - 336.6 Ohms

Natural Frequency - 230.7 cps, Damping - 0.615

#### RECORDED:

Oscillograph Channel 2-27 for Drop Test 1-27 for Flight Test

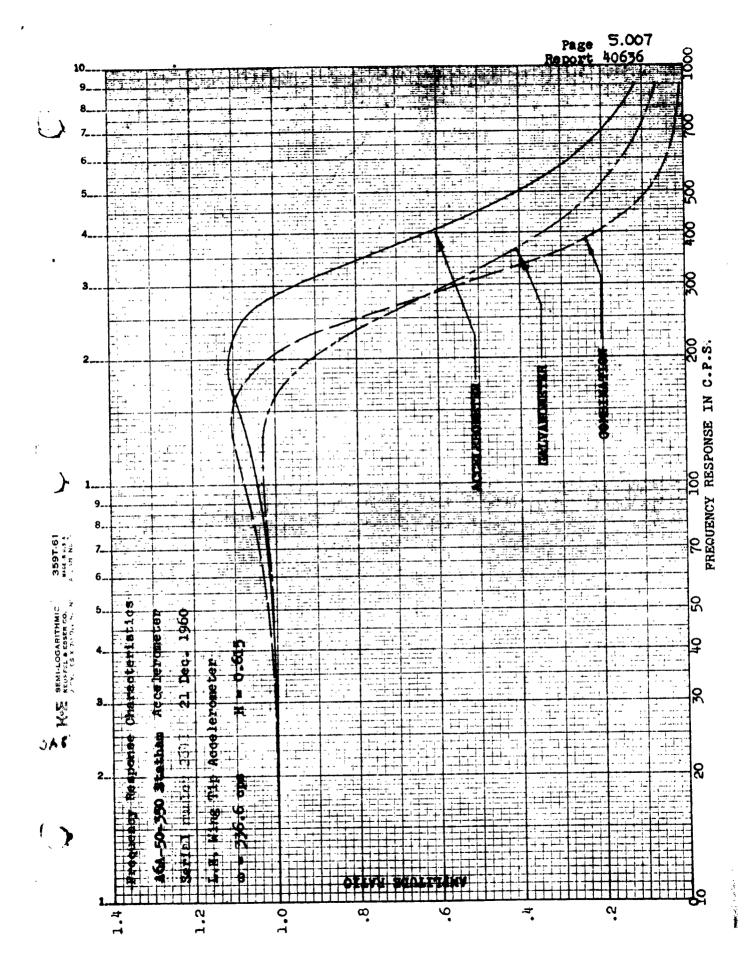


MV/CN

0.001 SEC/CM

0.010 SEC /CM

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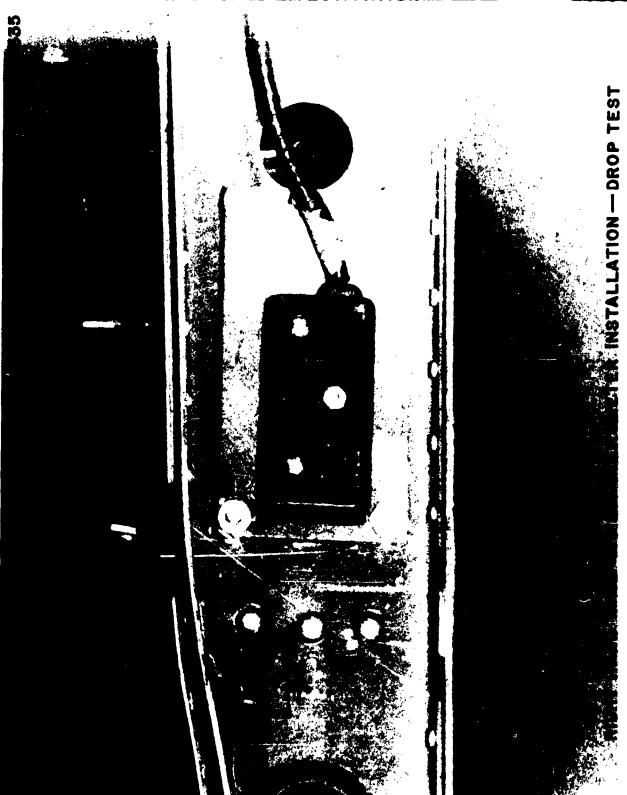
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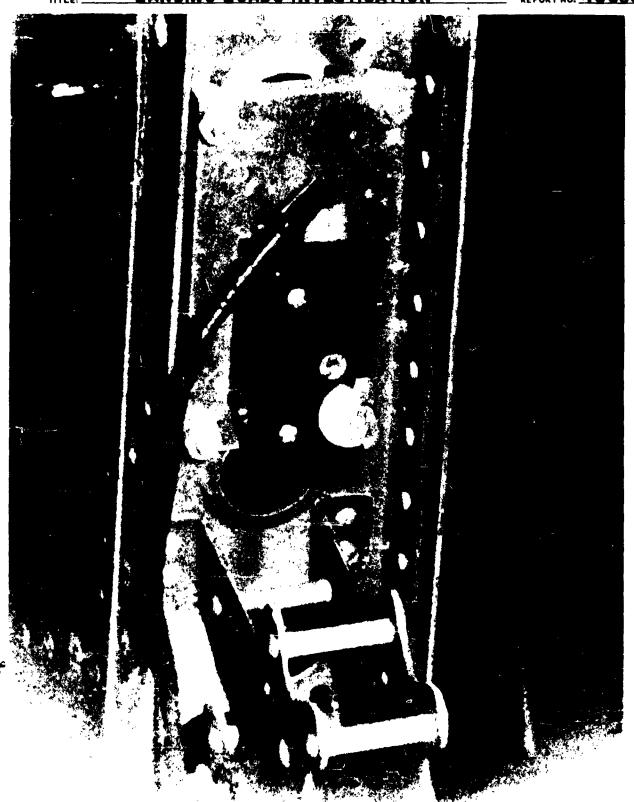
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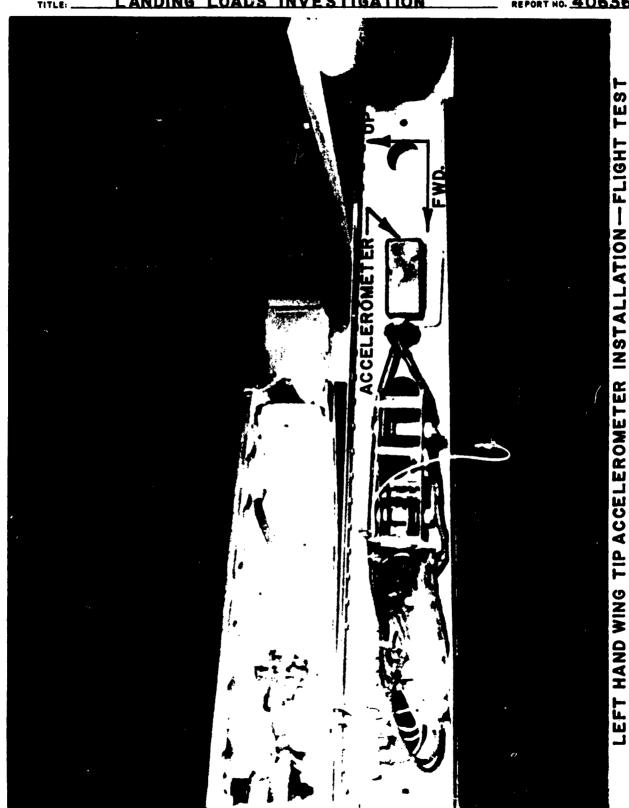


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REPORT NO. 40636

LOADS INVESTIGATION LANDING



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DATE

PAGE: 5.013 MODEL: <u>A4D=2</u> REPORT NO. <u>40636</u>

TITLE: LANDING LOADS INVESTIGATION

RIGHT HAND WING TIP ACCELEROMETER INSTALLATION - FLIGHT TEST

715

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PREP	ARED	BY.	I	E.	Hay	cris	<b>1</b>		
T171 F	L	dg.	. L	ads	I	ve	t1	gat	ion

PAGE 6.001
MODEL A4D-2
REPORT 40636

#### External Fuel Tanks Accelerations

Accelerometers were installed on two 150 gallon external fuel tanks as shown in the sketch on Page 6.023. The accelerometers were aligned to measure acceleration perpendicular and parallel to the airplane fuse-lage reference planes. The accelerometers were held in place with straps and the alignment with respect to the fuselage reference plane was achieved by using spacers contoured to the tank as seen in the photographs on Pages 6.024 and 6.025. These tanks were mounted at Sta. 75.00 (left and right) on the airplane for the flight test phase only.

The accelerations were measured for landings 138 through 156 only.

Photographs of the external tanks with the accelerometers installed are shown on Pages 6.024 and 6.025.

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FORM 25 5 1

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PREPARED BY I. E. Harris
TITLE Ldg. Loads Investigation

PAGE 6.002 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Measures left external fuel tank longitudinal acceleration at the center of gravity of the tank (Tank Sta. 76.5).

## CONSTANT:

7.909 01 1/50 K

#### CHARACTERISTICS:

#### TRANSDUCER

Type - Statham AJ43+10-350

Serial No. - 813

Natural Frequency - 110 cps

Damping Ratio - 0.90

#### GALVANOMETER

Type - CEC 7-342

Serial No. - 5021

Natural Frequency - 222.5

**Damping** - 0.586

#### RECORDED:

Oscillograph Channel 2-27 for Flight Test

LOAD	UP-SCALE DEVIATION	UP-SCALE PERCENT DEVIATION	DOWN-SCALE DEVIATION	DOWN-SCALE PERCENT - DEVIATION	AVERAGE DEVIATION
10600 02	48460 -01	•23	<b>30924 -01</b>	•15	•39692, 401
-075600 01	76510 -OT	•36	24057 -02	01	•37052 <b>-</b> 01
62500 01	38366 -01	•18	47126 -01 م-	£22	-443797 <del>-102</del>
40000 01	23923 -01	•11	-a72529 -0]	34	24303 -01
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18900 01		•11	-496825 -01	46	36542 -01
40000 01	46858 -01	• 22	93436 -01	44	23289 -01
462500 01	23647 -01	•11	44308 -01	<b></b> 21	10331 -01
475600 01	38114 -01	18	38610 -01	<b></b> 18	₩.24796 <b>-03</b>
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FORM 88-8 ( ( to 5 1) 8 8 1790

DATE
PREPARED BY I. R. Happis
TITLE Idg. Loads Investigation

PAGE 6.005
MODEL 440-2
REPORT 40636

#### DESCRIPTION:

Measures left fuel tank lateral acceleration at the forward end at Tank Sta. 38.0.

## CONSTANT:

7.583 G's/50 K

## CHARACTERISTICS:

#### TRANSDUCER

Type - Statham AJ43-10

Serial No. - 1606

Natural Frequency - 116 cps

Damping Ratio - 0.68

#### GALVANOMETER

Type - CEC 7-342

Serial No. - 4888

#### RECORDED:

Oscillegraph Channel 1-2 for Flight Test

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PREPARED BY I. R. Harris
Title Ide. Leads Investigation

PAGE 6.008

MODEL 640-2

REPORT 40-36

## DESCRIPTION:

Measures right external fuel tank lateral acceleration at forward end at Tank Sta. 38.0.

#### COMSTANT:

8.567 G's/50 K

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham AJ43-10-350

Serial No. - 596A

Natural Frequency - 128 cps

Damping Ratio - 0.80

#### GALVANOMETER

Type - CEC 7-342

Serial No. - 4958

## RECORDED:

Oscillograph Channel 1-3 for Flight Test

PREPARED BY: I.E. Happie

VITLE: Ide. Loads Investigation

REPORT NO.

#### TRANSDUCER CALIBRATION

# CALIBRATION PRIOR TO PLIGHT TEST PANSE

SERIAL 596A. D.R.O. 674280 PLANE A4D089 PROGRAM FOO4 ANALYST R. miller

Report 40636

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6.009

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PREPARED BY I. E. Harris
TITLE Idg. Loads Investigation

PAGE 6.011
MODEL 180-2
REPORT 40636

#### DESCRIPTION:

Measures left external fuel tank lateral acceleration at aft end at Tank Sta. 122.3.

# CONSTANT:

7.149 G'e/50 K

#### CHARACTERISTICS:

#### TRANSDUCER

Type - Statham F-10-350

Serial No. - 1905

Natural Frequency - 85 ops

Damping Ratio - 0.66

## GALVANOMETER

Type - 7-342

Serial No. - 6173

#### RECORDED:

Oscillograph Channel 1-4 fer Flight Test

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PREPARED BY I. E. Harris
TIVLE Ide. Leads Investigation

PAGE G.014 MODEL ALBOR REPORT 40616

#### DESCRIPTION:

Measures left external fuel tank normal acceleration forward end at Tank Sta. 38.0.

## COMSTANT:

18.930 0's/50 K

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham AJ43-25-350

Serial No. - 1251

Natural Frequency - 208 ops

Damping Ratio - 0.66

## GALVANOMETER

Type - CEC 7-342

Serial No. - 5097

## RECORDED:

Oscillograph Channel 1-5 for Flight Test

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FORM 85-9-1

PREPARED BY I. B. Harris
TITLE Idg. Leads Investigation

PAGE 6.017 MODEL A4D-2 REPORT 40636

#### DESCRIPTION:

Measures right external fuel tank normal acceleration at forward end at Tank Sta. 38.0.

#### CONSTANT:

18.356 G's/50 K

#### CHARACTERISTICS:

#### TRANSDUCER

Type - Statham AJ43-25-350

Serial No. - 1252

Natural Frequency - 210 cps

Damping Ratio - 0.72

#### GALVANOMETER

Type - 7-342

Serial No. - 6157

#### RECORDED:

Oscillograph Channel 1-6 for Flight Test

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FORM 85.8.1 (3-51)

PREPARED BY I. R. Harris
TITLE Lds. Loads Investigation

PAGE 6.020

MODEL A4D-2

REPORT 40636

### DESCRIPTION:

Measures left external fuel tank normal acceleration at aft end at Tank Sta. 122.3.

#### CONSTANT:

18.980 G's/50 K

## DESCRIPTION:

#### TRANSDUCER

Type - Statham AJ43-25-350

Serial No. - 1253

Natural Frequency - 210 cps

Damping Ratio - 0.74

#### GALVANOMETER

Type - CEC 7-342

Serial No. - 7317

Natural Frequency - 225 cps

Damping - 0.574

#### RECORDED:

Oscillograph Channel 1-34 for Flight Test

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REPORT NO. 40636

LANDING LOADS INVESTIGATION

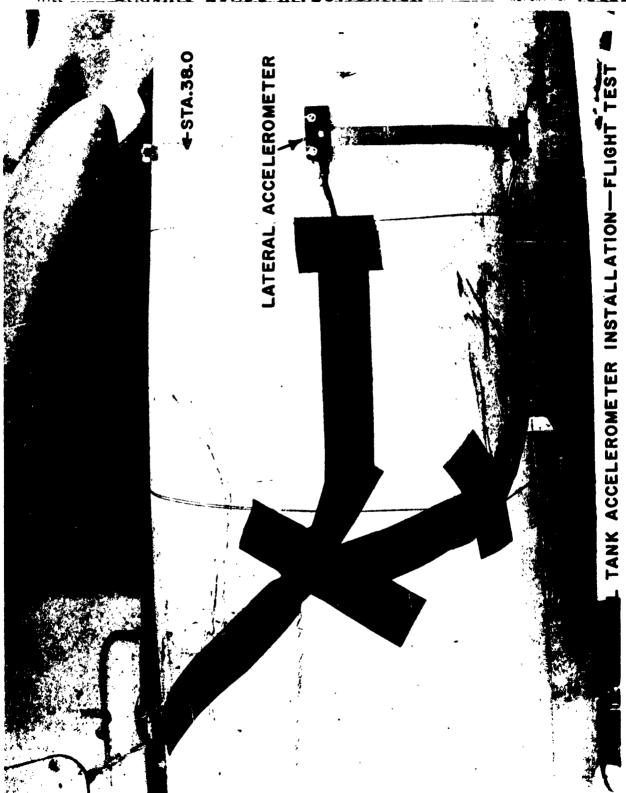
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PAGE: 6.025 MODEL: A4D-2

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LANDING LOADS INVESTIGATION



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PREPA	RED BY	I.E.	Harris	_
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7.001
MODEL A4D-2
REPORT 40636

## NOSE EQUIPMENT RACK ACCELERATIONS

Accelerometers were installed in the nose of the airplane on the forward and aft ends of the equipment rack, P/N 5547318. Accelerometers were also installed on the airframe structure, Airplane Sta. 29 and 49, below the accelerometers on the equipment rack. The accelerometers were oriented to measure normal accelerations perpendicular to the fuselage reference line. Photographs of the installation are shown on Pages 7.011 and 7.012. The accelerations were measured during the flight test phase only for landings 138 through 156.

FORM 88-9-1

 $G_{\parallel}$ 

DOUGLAS AIRCRAFT COMPANY, INC.

DATE PREPARED BY I. E. Harris
Tiple Lide Leads Investigation

7.002 Model 440-2 Report 40636

## DESCRIPTION:

Measures acceleration of equipment rack, forward end.

## CONSTANT:

80.73 G's/50 K

## CHARACTERISTICS:

## TRANSDUCER

Type- ASA-200-380

Serial No. - 3025

Natural Frequency - 1065 cps

Damping Ratio - 0.74

## GALVANOMETER

Type - CEC 7-342

Serial No. - 7327

#### RECORDED:

Oscillograph Channel 1-23 for Flight Test

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FORM 25-2-1

#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY I. B. Harris
Time Idg. Loads Investigation

7,004 Model 450-2 Report 40636

# DESCRIPTION:

Measures acceleration of nose equipment rack, aft end.

## CONSTANT:

74.206 01s/50 K

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham ASA-200-380

Serial No. - 3026

Natural Frequency - 1225

Damping Ratio - 0.94

#### GALVANOMETER

Type - CEC 7-342

Serial No. - 7302

#### RECORDED:

Oscillegraph Channel 1-25 for Flight Test.

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## DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY I. S. Marris
TIME Ide. Loads Investigation

PAGE 7,006 MODEL AMAG REPORT 40634

## DESCRIPTION:

Measures acceleration of structure at Sta. 29.375.

## CONSTANT:

72.147 0's/50 K

## CHARACTERISTICS:

## TRANSDUCER

Type - Statham ASA-200-380

Serial No. - 1464

Natural Frequency - 1110 cps

Damping Ratio - 0.74

## GALVANOMETER

Type - CEC 7-342

Serial No. - 4903

# RECORDED:

Oscillograph Channel 1-13 for Flight Test

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PREPARED BY I. B. Harris

PAGE 7,008 MODEL ABD-2 REPORT 40636

## DESCRIPTION:

Neasures acceleration of structure at Sta. 49.375.

## CONSTANT:

62.165 0's/50 K

# CHARACTERISTICS:

# TRANSDUCER

Type - Statham A6-100-350

Serial No. - 10019

Natural Frequency - 366 cps

Damping Ratio - 0.45

## GALVANONETER

Type - CEC 7-342

Serial No. - 7315

## RECORDED:

Oscillograph Channel 1-24 for Flight Test.

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		LOA 1000 8000 6000 4000 2000 2000 2000 6000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	32229222	2041 8600 1281 336 2540 179 116 952 195	#SCATVIAT #9 05 07 75 75 76 62	DE ION 00 00 00 00 00 00 00 00 00 00 00 00 00	UP.	•10 •10 •10 •10 •13 •10 •13 •10 •10 •10 •10	LE -			16344 16344 1834 1489 1297 1804 1789 1789 1789 1789	GZ- ATIO 42 +0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EN 0011000000000000000000000000000000000	PE	N-519 N-5ERCE/RAT 80027 10027 10037	CAL	702	12121212	0EV 841 385 9189 5787 4574 179	6: - 7 7 7 1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	00 00 00 00 00 00 00 00 00 00 00 00 00		
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	<b>&amp;</b>	LOA 1000 8000 6000 4000 2000 2000 2000 6000	0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	32229222	2041 8600 1281 336 2540 179 116 952 195	#SCATVIAT #9 05 07 75 75 76 62	DE ION 00 00 00 00 00 00 00 00 00 00 00 00 00	UP.	•10 •10 •10 •10 •13 •10 •13 •10 •10 •10 •10	LE -			16344 16344 1834 1489 1297 1804 1789 1789 1789 1789	GZ- ATIO 42 +0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EN 0011000000000000000000000000000000000	PE	N-519 N-5ERCE/RAT 80027 10027 1004 1004 1004 1004 1004 1004 1004 100	CAL	702	12121212	0EV 841 385 9189 5787 4574 179	6: - 7 7 7 1 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	00 00 00 00 00 00 00 00 00 00 00 00 00		
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FORM LB25- S- 1A (3-52)

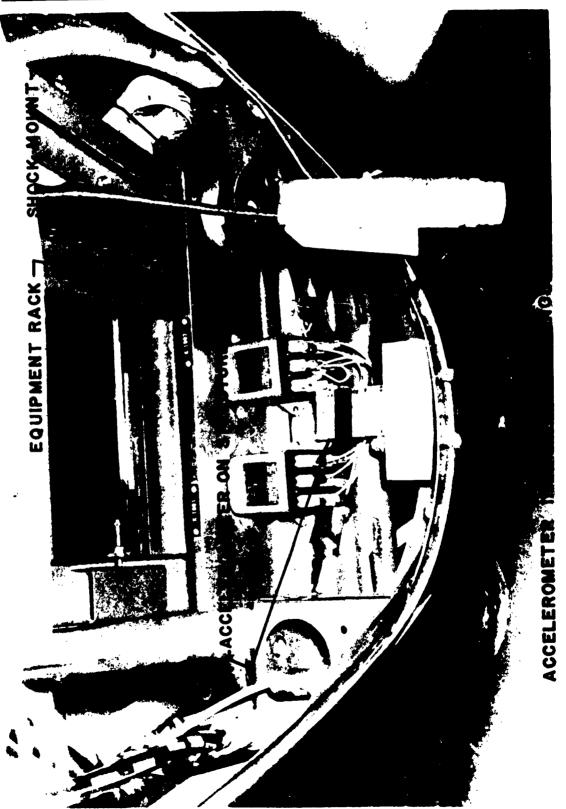
DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BY:

PAGE: 7.012 MODEL: A4D-2

LANDING LOADS INVESTIGATION

REPORT NO. 40636



PREPARED BY I. E. Harris
Title Ldg. Loads Investigation

PAGE 8.001 MODEL 1A40-2 REPORT 40636

## FLIGHT TEST GENERAL INSTRUMENTATION

#### Photoscope

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A Douglas Aircraft Company-developed photoscope was used to obtain horizontal and vertical speeds at airplane touchdown.

The DAC photoscope is a 35 mm camera running at a precise rate of 20 frames/sec. The speed is controlled by a precision power supply with a power requirement of 24 ± 1 volt D.C. A circular etched glass grid graduated in 2 degree increments of elevation and 1 degree increments of azimuth is located in close preximity to the film plane and the grid lines are super-imposed on the photograph of the airplane. The camera must be leveled prior to use to assure that the grid lines are perpendicular and parallel to a horizontal line in space. This grid is fixed with respect to the mounting base, and the camera body containing the lens and film rotates in a horizontal plane. The camera base (with glass grid) is locked in position after leveling and alignment. The camera has a 6 1/8 inch f4.5 lens and a shutter speed of 1/284 second. The film capacity is 100 ft. of 35 mm film.

The camera for the subject landings was located 525.5 feet from the centerline of the runway and 100 ft. on the approach side of the intended touchdown area. The camera was attached to a concrete platform to assure rigidity. A photograph of the photoscope is shown on Page 8.002.

Camera level checks were performed before and after each series of landings. These level checks were made by photographing a target beard placed in turn on several points of known elevation relative to the photoscope camera.

Certain markings were placed on the airplane to provide scale checks for check purposes with the photoscope film. The tires were marked as an aid in determining the touchdown point in the photoscope film. These markings are shown on Page 8.003.

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PREPARED BY: \_\_\_\_\_\_DATE

TLE: LANDING LOADS INVESTIGATION

PAGE: 8.002 MODEL: A4D-2 REPORT NO. 40636

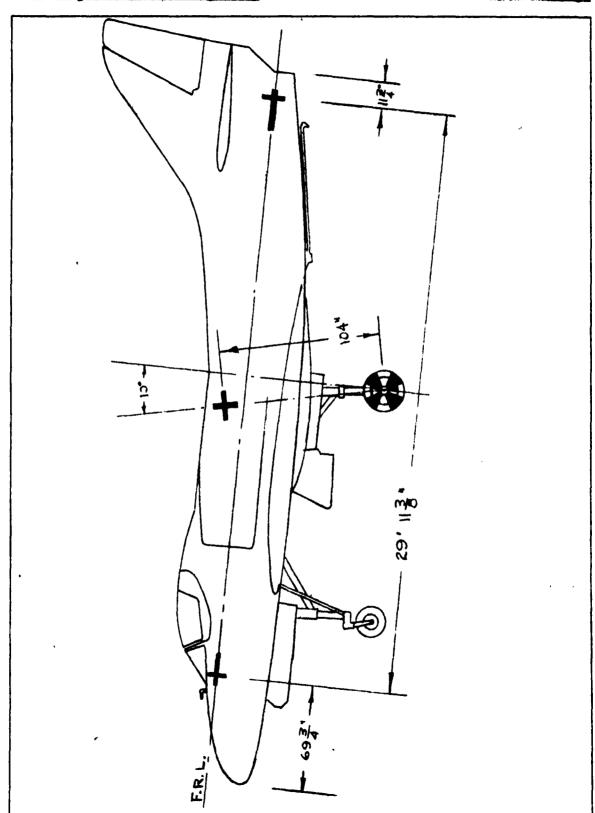
PRECISION POWER SUPPLY **PHOTOSCOPE** LEVELING HEA

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PREPARED BY S. F. Tydeman
TITLE Ldg. Loads Investigation

PAGE 8.003
MODEL AD-2
REPORT 40636



# FORM 85-5 1

#### DOUGLAS AIRCRAFT COMPANY, INC.

DATE		<del> </del>		
PREPA	RED BY	I.E.	Harris	
TITLE	Ide.	Loads	Investi	gation

PAGE 8.201 MODEL A4D-2 REPORT 40636

## Touchdown Rate of Descent Indicator (TRODI)

Four TRODI units were used for instantaneous reading of vertical speed of the airplane at touchdown.

Two TRODI units were placed on each side of the runway near the area of intended touchdewn. The TRODI mirrors were mounted on the main landing gear of the airplane. The TRODI mirrors installation on the left and right main gears can be seen in the photographs on Pages 2.411 and 2.412.

The eperation, calibration, set-up and alignment of the TRODI equipment were handled by NATC personnel.

20. 25.25

DATE			
PREPARED BY	I.B.	Harris	
TITLE LAR.			

PAGE 8.101 MODEL A4D-2 REPORT 40636

## Mitchell Camera

The Mitchell camera was used to measure horizontal and vertical speeds and was used as a back-up data source for the DAC photoscope. The Mitchell camera was operated and the data reduction from the film was completed by NATC personnel.

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FORM 35 3 1

PREPARED BY I. E. Harris
TITLE Idg. Loads Investigation

PAGE 8.301
MODEL 440-2
REPORT 40636

## Speed Over Deck Indicator (SODI)

The SODI was used for instantaneous reading of horizontal speed at touchdown and was operated by NATC personnel. The SODI units were placed near the runway edge to the left of the intended touchdown point. The SODI mirrors were installed on the underside of the fuselage, left and right, near the aft end of the nose gear drag strut.

#### AN/SPN-12 Approach Radar

The AN/SPN-12 radar equipment was used by the LSO at the landing site to monitor the airplane approach speed and the horizontal velocity at touchdown. Set-up, calibration, and operation of the equipment were handled by NATC personnel.

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FORM 85-% 1

PREPARED BY I. E. Harris
TITLE Idg. Loads Investigation

PAGE 8.401 MODEL 445-2 REPORT 40636

## Yaw and Sideslip Camera

An 16mm movie camera, designation N-9, was installed on the right side of the airplane at Sta. 86.0 to photograph a view downward. Grid lines were painted on the runway and the intent was to photograph the grid lines and determine yaw angle and drift speed at airplane touchdown. The camera operated during appreximately 50% of the landings and on those landings for which film was obtained correlation with the oscillograph records was not possible. A photograph of the camera installed on the airplane is shown in Page 8.402.

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PAGE: **8.402**MODEL: **A4D-2** 

TITLE: LANDING LOADS INVESTIGATION

REPORT NO. 40636



FORM 27 5 1

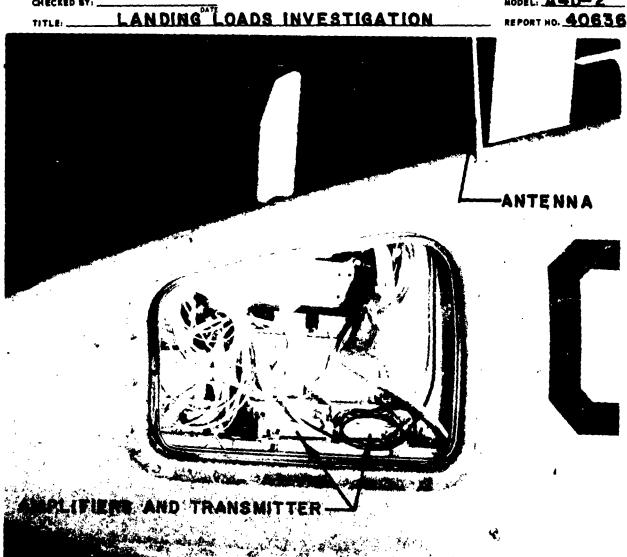
PREPARED BY I. E. Harris
Title Ldg. Loads Investigation

PAGE 8.501 MODEL 44D-2 REPORT 40636

#### Telemetry Equipment

Crystal type accelerometers were installed on the nose electronic equipment rack adjacent to the accelerometers discussed on Page 7.001 of this report. These accelerometers measured vertical shock loads applied to the equipment rack. Due to the high frequency expected, the results were telemetered to a ground station and collected on magnetic tape. A photograph of the airborne transmitter installed in the airplane is shown on Page 8.502.

The carrier frequency assigned to the telemetry system conflicted with a high priority project operating at the Naval Air Test Center and as a result, usable data were not obtained.



TELEMETERY INSTALLATION IN NOSE COMPARTMENT FLIGHT TEST

FORM 25-5 1 1 (= 5 1) E 3 11700

PREPARED BY H. D. Meriwether
Title Idg. Loads Investigation

9.001 Model 440-2 Report 40636

## Drop Test Reaction Platform Loads

For the drop test phase of the program, the ground reactions for both main landing gears and the nose landing gear were measured with reaction platforms of Douglas Aircraft Company design. These platforms (E.S. Static Test Drawing 31296) are of 60,000 lb. capacity. The platforms utilize strain gage links to measure the loads. Photographs of the two main gear reaction platforms are shown on Pages 9.005 and 9.017. A photograph of the nose gear reaction platform is shown on Page 9.028. The procedure followed for adjusting the drag preload on the platforms to eliminate a back-lash condition in the links near zero drag loads is detailed on Page 9.023.

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#### DOUGLAS AIRCRAFT, COMPANY, INC.

PREPARED BY H. D. Meriwether
Title Idg. Loads Investigation

PAGE 9.002 MODEL 440-2 REPORT 40636

#### DESCRIPTION:

Right hand gear vertical platform. This transducer measures vertical deck forces induced by the landing gear.

#### CONSTANT:

Lbs = 47650 5/ $\Delta/250$ K Ohms Resistor Calibration

## CHARACTERISTICS:

## TRANSDUCER

Type - DAC Design E.S. 5212457

Serial No. - 2

Natural Frequency - Approx. 90 cps (Vertical)

## GALVANOMETER

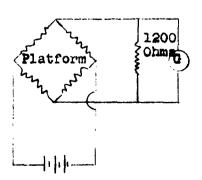
Type - 7-342

Serial No. - 4978

Resistance - 344.7 Ohms

Natural Frequency - 227.8 cps

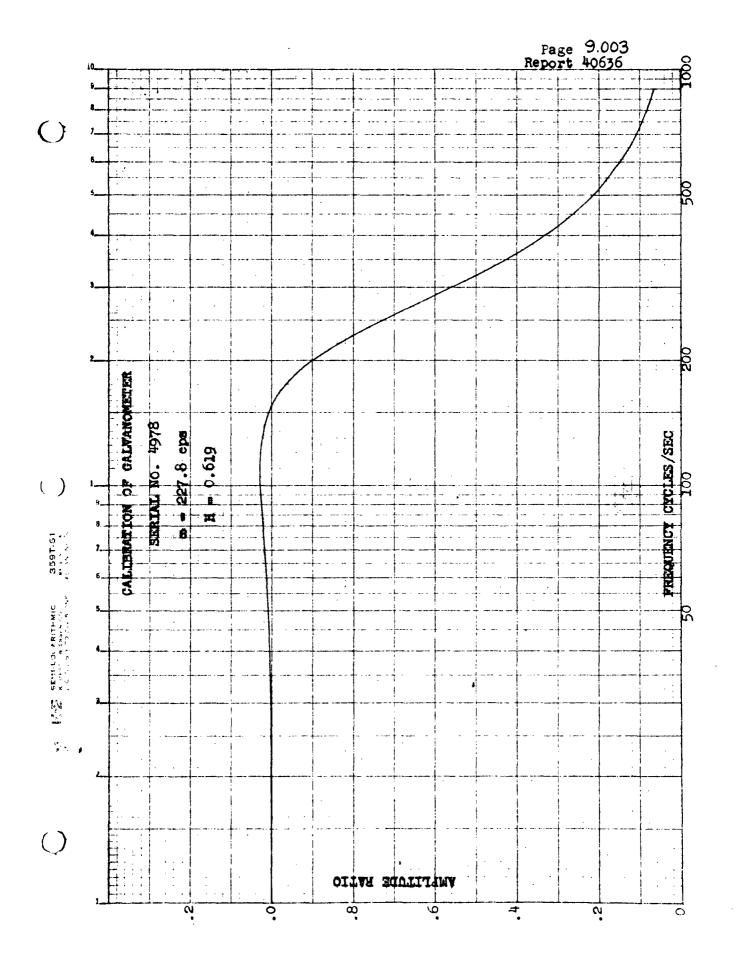
Damping - 0.619



## RECORDED:

Oscillograph Channel 2-8 for Drop Test

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# DOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

PREPARED BY H.D. MERIWETHER DATE 26 NAY 1961
TITLE LANDING LOADS INVESTIGATION

MODEL A40+2

## RECALIBRATION OF CYNAMIC REACTION PLATFORM 2

#### R.H. SIDE, FERTICAL LUAD

TEST	RUN	ÇHANNEL	LCAD	READING		<b>Y</b> ,
2	2	j		7+70	,	
2	2	? 8	5000	793	. 10883	5000
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2	?	8	15600	2350	.31457	15000
2	2	8	20000	3126	.41847 .52316	20000
2	2	8 8 8 8	25000	3700	-52316	125000
2	. 2	Ą	30660	4685	.62731	30000
2	12	13	35000		.73280	35000
2,	Ž.	8	40660 -	6256	.83748	40000
2	2	S	45000	7°56 i	.94453	
2	2	8	5 <b>000</b> 0	7840	1.04953	50000
INTER	RCEPT AVE.D	SLOPE ELTA Y	1 SL	OPL 2 MAX	SLOPE 3 CMITTE	SLOPE 4
- 12		47723. •258	74.643	+95.82	.00	000
39	7.306	47655.	991			
		.106		-56.16	.10	683
3 '	1.552	47656.	.052			
	4 1	•465	57.302	-43.07.	٠٤2 .	731
36	5.772	47633	.674			
	37	. 252	57.374	-48.13	3 .83	748
35	5.962	47618.	498			
		.639		-44.13	.73	280

FORM LB25- S- 1A (3- 52)

DOUGLAS AIRCRAFT COMPANY, INC.

REPORT NO. 40636



FORM 28-9-1 ( 1-51)

1 1

PREPARED BY H. D. Meriwether
Title Ide. Loads Investigation

PAGE 9.006 MODEL A4D-2 REPORT 40636

## DESCRIPTION:

Right hand gear drag platform. This transducer measures horizontal deck forces induced by the landing gear.

## CONSTANT:

Lbs. = 11411.8  $5/\Delta$  / 250K Ohms Resistor Calibration

#### CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Design E.S. 5212457

Serial No. - 2

#### GALVANOMETER

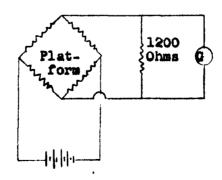
Type - 7-342

Serial No. - 4903

Resistance - 354.1 Ohms

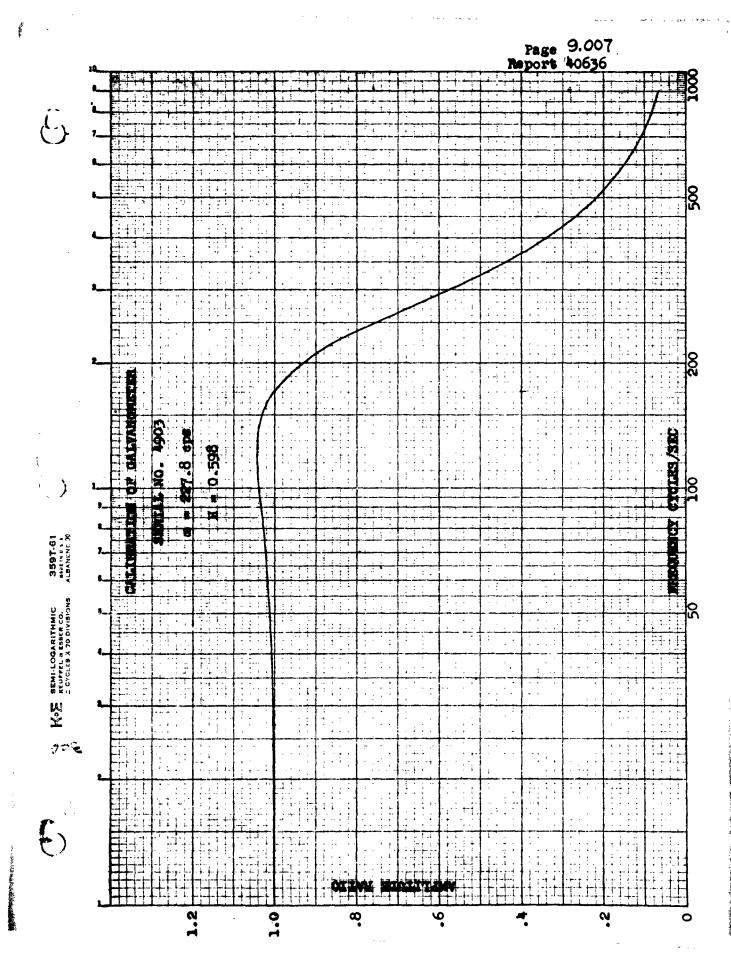
Natural Frequency - 227.8 cps

Damping - 0.598



#### RECORDED:

Oscillograph Channel 2-12 for Drop Test



6 Jan. 1961

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DCUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION PAGE 9.008
Report 40636

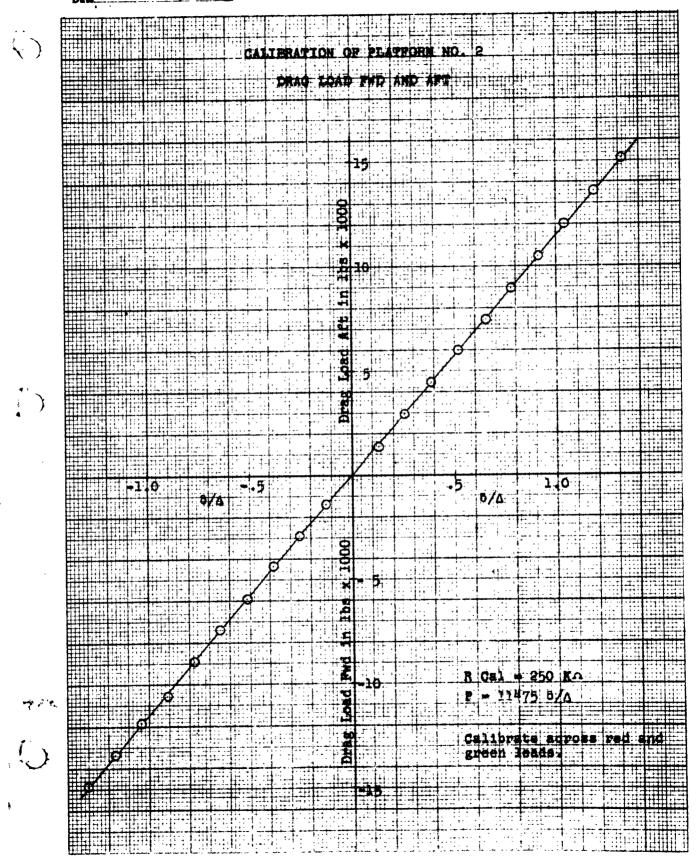
# DRAG LOAD FUD AND AFT

 $P = 11,475 \ \delta/\Delta @ 250 \ K$ 

TEST	RUN	CHANNEL	LCAD	READING	X	Y
2	1	2		1176		
2	1	2	-1425	-153	12793	-1425
2	1	2	-2918	-306	25585	-2918
2	1	2	-4366	-461	38545	-4366
2	1	2	-5906	-618	51672	-5906
2	1	2	-7400	-773	64632	-7400
2	1	2	-8893	-929	77676	-8893
2	1	2	-10564	-1086	90803	-10564
2	1	2	-11834	-1243	-1.03930	-11834
2	1	2	-13374		-1.17057	-13374
2	1	2	-14868		-1.30184	-14868
2	1	2	1393	152	.12709	1393
2	1	2	2975	304	.25418	2975
2	1	2	4440	462	.38629	4440
2	1	2	59 <b>9</b> 8	619	.51756	5998
2	1	2	7462	779	.65134	7462
2	1	2	8974	931	77843	8974
222222222222222222222222222222222222222	1	222222222222222222222222222222222222222	10508	1088	.90970	10508
2	1	2	12020	1242	1.03846	12020
2	1	2	13579	1410	1.17893	13579
2	1	2	15161	1573	1.31522	15161
INTE	RCEPT	SLOPE	1 SL	OPE 2	SLOPE 3	SLOPE 4
	AVE-DE	LTA Y	M7X*+	MAX	OMITTE	
3	1.769	11499.	517		·	
			75.259	-162.78	0	0000
<b>1</b> a (	n.078	11476.	409			
•	20	249	60.912	- 106.55	5 00	1007
ě	476	247	00.712	- 100.33	590	70 <b>03</b>
4.	488.6	11477.	417			
-			54.278	-60.54	1 .12	700
			0.04.0	00134	•	
51	0.396	11480.	718	•		
	21.	477	47.487	-45.25	6 .65	134
<b>%</b>	7.055	11485.	704			
•	10.	491	45.481	-1.3. Ah	1 -1.03	10 30
	- , ,		430401	73.04	- 1403	7 34

FORM 25 88 (5-51) Analysis Idg. Loads Investigation
Prepared by H. D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.
Date 6 Jan. 1961

Page 9.009 Model A4D-2 Report No. 40636



PORM 45-5-1 (3-51) 6 8 MTHE

PREPARED BY H. D. Meriwether Title Ldg. Loads Investigation

9,010 MODEL . 40636 REPORT

.

## DESCRIPTION:

Left Hand Main Gear Reaction Flatform No. 1. This transducer measures the vertical deck forces induced by the landing gear. See photograph ES 201343.

## CONSTANT:

Drops 1 through 14

for 250 K Ohm Calibrating Lbs. = 47380 6/A Resistor

Drops 15 through 31

for 250 K Ohm Calibrating Lbs. = 47487 5/A Resistor

#### CHARACTERISTICS:

## TRANSDUCKR

Type - DAC Design ES 5212457

Serial No. - 1

Natural Frequency - Apprex. 90 cps (Vertical)

#### GALVANOVETER

Type - CEC 7-342

Serial No. - 5118

Resistance - Galve sees 344.7 Ohms

Natural Frequency - 217.3 ops

Damping - H = 567.

#### RECORDED:

Oscillograph Channel 1-8 for Drop Test (Drops 1-31)

£ 13 6

3-511

PREPARED BY He Do Mariwether
Title Lake Loads Investigation

MODEL AME A

## DESCRIPTION:

Left Hand Main Gear Reaction Platform No. 6. This transducer measures the vertical deck forces induced by the landing gear. See photograph ES 201343.

#### CONSTANT:

Lbs. = 48450 5/A for 250 K Ohm Calibrating Resister

#### CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Design E8 5212457

Serial No. - 6

Matural Frequency - Apprex. 90 cps (Vertical)

## GALVANGMETER

Type - CEC 7-342

Serial No. - 5118

Resistance - Galve sees 344.7 Ohms

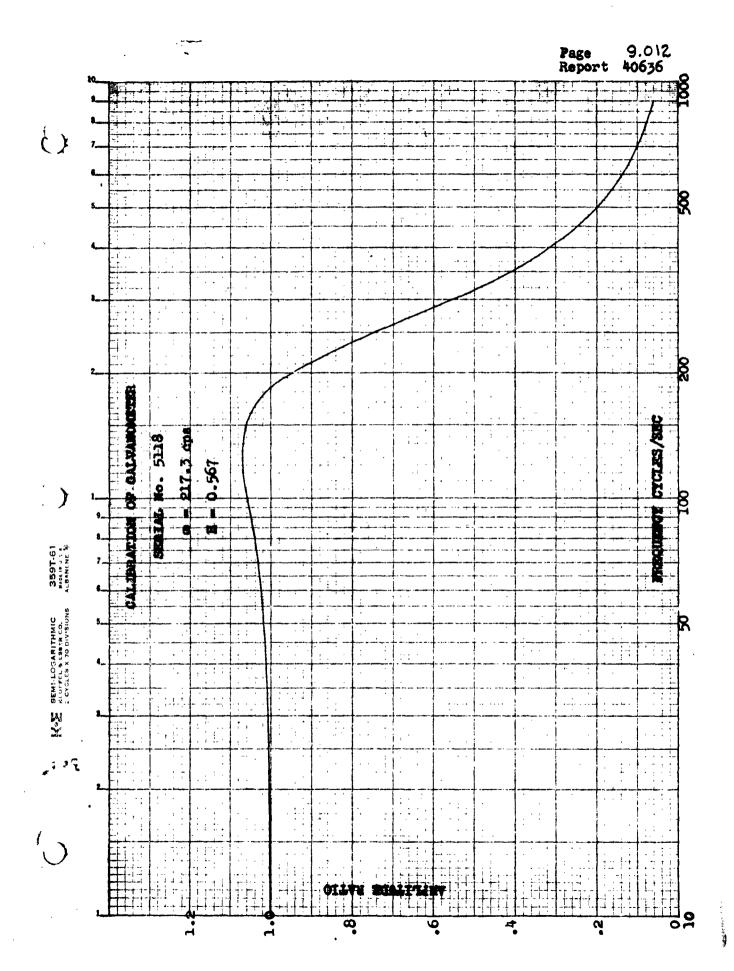
Natural Frequency - 217.3 cps

Demping - H = 567.

## RECORDED:

Oscillegraph Channel 1-8 for Drep Tests (Dreps 32 and Subs)

THE REAL PROPERTY.



4 Jan. 1961

DOUGLAS AIRCRAFT COMPANY. HIE. EL SEGUNDO DIVISION

PAGE 9.018

Report - 40636

## CALIBRATION OF PLATFORM NO. 1

## VERTICAL LOAD

## P = 47,480 5/∆ € 250 K

TEST	RUN	CHANNEL	LCAC	FIABING	x	Y
ı	1	1		1125		
į	1	1	5000	117	.16400	5000
Ι.	<b>.</b>	1	10000	<b>≘36</b>	.20978	10000
ì	1	, 1 ·	15000	353	.31378	15000
1	1	7	20000	473	.42044	20000
1	1	· 1	25000	0.89	.52356	25000
1	7	1	30000	709	.63022	30000
1	ì	1	35000	327	.73659	35000
1	1	:	40000	245	.84267	40000
. 1	1	1	4503 <b>0</b>	1366	.74756	45000
1	. 1	1	SOCCC	1184	1.05244	50000
1	;	1	55000	1304	1.15911	55000
1	1	1	60000	1427	1.28844	60000

INTERCEPT S AVL. DELTA	LODE 1 SLOPE Y XAX.+	2 SLCPE	S SLOPE :
133.01c 4 45.76c	/314.151 94.797	- 148.988	•00000
98.216 4 32.726	7371.724 87.084	. 34,945	1.26244
83.694 4 23.688	7430.487 43.526	-27.215	.52356
78.582 4 19.633	7400.717 48,124	-22.131	.63022°
43 770 1	71. 1 3		

-23.204

7. 1

CT.

PREPARED BY H.D. MERIWETHER DATE 24 MAY 1961 TITLE LANDING LOADS INVESTIGATION

MODEL A40+2 REPORT NO. 40636

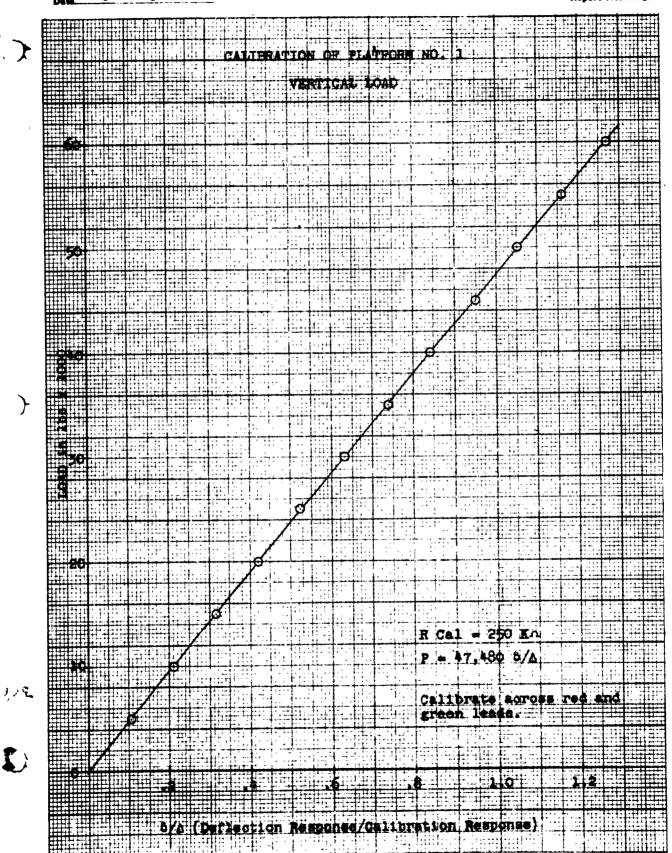
## RECALIBRATION OF DYNAMIC REACTION PLATFORM 6

L.H. SIDE, VERTICAL LOAD

and the second	¥	• •				
TEST		CHANNEL	LOAD	READING	<b>x</b>	; <b>Y</b>
6	2	10		7689	•	•
6	2	10	4980	829	.10782	4980
6	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	10	10 <b>03</b> 5	1623	.21108	10035
6	2	10	14975	2421	.31487	**************************************
6	2	10	19925	3242	.42164	19925
6 6 6 6	2.	10	24990	4005	.52087	24990
6.	2	10	29965	4821	.62700	29965
6	2	10	34960	5666	.73690	34960
6	2'	10	<b>36600</b> ,	6470	.34146	36600
6	'2	10	44850	7272	.94577	44850
6	2	10 -	49895	8077	1.05046	49895
INTE	RCEPT	SLOPE	1 St	.OPL 2 S	LOPE 3	SLOPE 4
	AVE D	ELTA Y	MAX .+	MAX	OMITTE	D X
21	5.058	46559	489		•	
	611	1.779	769.982	-2794.091	.00	0000
~ 1.	3.627	47544.	.531			
•	97	.592	239.066	-152.262	.84	146
-41	8.649	47553.	579			•
		562		-98.405	.52	180
-6	5.738	47533.	.003		,	
	4.8	-80¥	74.240	-79.098	.62	700
-1	1.967	47466.	940			
		-934		-77-014	. 10	782

PORM 45 06 (5-51) Analysis Ldg. Loads Investigation
Propared by H. D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.
Date 4 Jan. 1961

Page 9.016 Model A4D-2 Report No40636



#### DOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION

PREPARED BY H.D. MERIWETHER DATE 24 MAY 1961 TITLE LANDING LOADS INVESTIGATION

MODEL A40+2 REPORT NO. 40636

## RECALIBRATION OF DYNAMIC REACTION PLATFORM 6

L.H.	SI	De.	VERT	ICAL	LCAD
------	----	-----	------	------	------

TEST	RUN	CHANNEL	LOAD	READING	X	Y
6	3	10		7702 .		
6	3	10	5000	928	.10750	5000
6	3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	10	10000	1634	.21215	10000
6	3	10	15000	2440	.31680	15000
6	3	10	20000	3246	.42145	20000
6	3	10	25000	4048	.52558	25000
6	3	10	3 <b>000</b> 0	4850	.62971	30000
6	3	10	35000	5650	.73358	35000
6	3	10	40000	64.64	.83926	40000
6	3	10	45000	7254	.94183	45000
6	3	10	50000	8114	1.05349	50000
INTE	RCEPT	SLOPE	1 SL	OPE 2 S	LOPE 3	SLOPE 4
	AVE.D	ELTA Y	MAX.+	MAX	OMITTE	D X
-109	7.880	47756.	.760			
	56	-840	130.974	-201.513	• 00	0000
-17	3.085	47919.	699			
		.860		-44.122	1.05	5349
-18	1.535	47948.	430			
		-462		-26.281	.8.	3726
-20	1.954	47979.	. 126			
		.673		-18.800	.10	750
-22	6.534	48013.	.992			
	ક	.552	15.662	-8.913	.2	1215

FOI	**	L	125.	5.	۱.	
	-	••				

LOADS INVESTIGATION

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PREPARED LOG. LOGIS INVESTIGATION

PAGE 9,018 MODEL 440.36 REPORT 400.36

DESCRIPTION:

Left hand drag platform.

## CONSTANT

Drops 1-14 D = 11438  $5/\Delta$  / 50 K Chms Reais. Calib. Drops 15-31 D = 11420  $5/\Delta$  / 50 K Chms Reais. Calib. Drops 32 and Subs. D = 11644  $8/\Delta$  / 50 K Chms Resis. Calib.

#### CHARACTERISTICS:

## TRANSDUCER

Type - DAC Dwg. 5212457

Serial No. - 6, drops 32 and subsequent

## GALVANOMETER

Type - 7-342

Serial No. - 7327

Resistance - 354.4 Ohms

Natural Frequency - 222.0 cps

**Damping - 0.564** 

## RECORDED:

Oscillograph Channel 1-14 for Drop Test

116

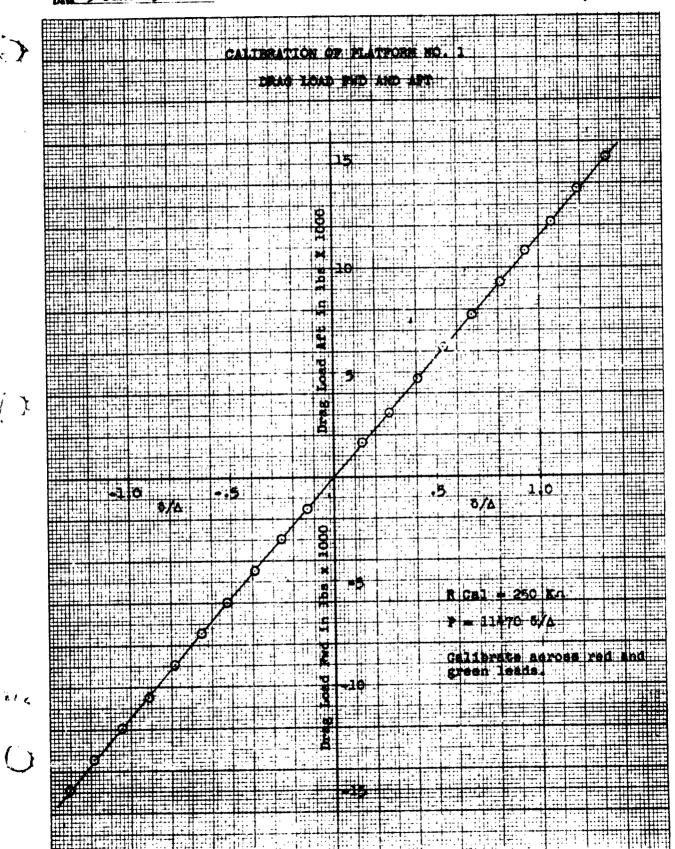
[-

FORM 45 06 (5-51) Analysis Ldg. Loads Investigation

Propered by H. D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.

Date 9 Jan. 1961

Page 9.020 Model A4D-2 Report No. 40636



## CALIBRATION OF PLATFORM NO. 1 BRAG LOAD FWD AND APT

## P = 11470 8/A @ 250 K

TEST	RUN	CHANNEL	LOAD	READING	×	<b>Y</b>
1	1	2		1063		. '
i	į	2 2 2 2 2 2 2 2 2 2	-1530	-143	13452	-1530
Ť	i	2	-2983	-276	25964	-2983
i	í	2	-4481	-416	39135	-4461
i	i	2	-5992	~55 <b>5</b>	52211	-5992
,	i	ž	-7444	-694	65287	-7444
•	i	2	-8947	-933	78363	-8949
i	• •	2	-10505	-971	91345	-10505
ί.	i	. 5	-11932	· -1110	-1.04421	-11932
i	i	2	-13462	-1258	-1.18344	-13462
•		2	-14915	-1390	-1.30762	~14915
*	i	2	1634	143	.13452	1634
÷	1	2	3060	283	.26623	3060
į	į	2	4695	429	.40357	4695
•	1	2 2 2 2 2	6199	566	.53246	6199
•	, i	2	7756	712	.66980	7756
1	i	2	9312	959	.80809	9312
1	,	2	10816	790	.93133	13816
	. L	2	12:191	1125	1.05833	12191
	1	2	13773	1262	1.18721	13773
i	Ï.	2	15278	1414	1.33020	15278
INTE	ERCEPT	SLCR€	1 St	OPE 2 .	SLOPE 3	SLOPE 4
•		ELTA Y	MAX.+	MAX.	- OMI	TTED X
•	531028	11496	858			
-	37	.184	82.707	-65.3	131	.00000
1	48:195	11476.		٠		
	3.3	8 <b>. 638</b>	77.823	-68.9	374 1.	. 18721
	431049	11470	790			

30.312 69.978 -70.027 .93133 461799 11464.959 28.710 59 59. 329 -53.008 -.91345 H31038 11472.913 -1.18344 -47.182 25.419

PREPARED BY H.D. MERIWETHER
DATE 4/21/61
TITLE LANDING LOADS INVESTIGATION

MCDEL A4D-2 REPORT NO. 40636

## L.H. DRAG PLATFORM CALIBRATION

## EFFECTIVE DROP 32 AND SUBS

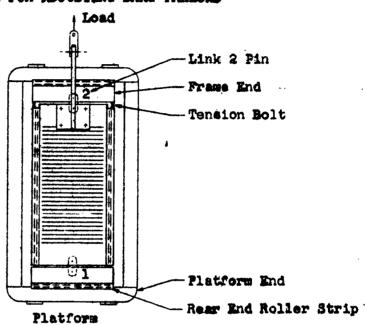
			•			
TEST	RUN	CHANNEL	LOAD	READING	X	Y
32	. 6	16		718		
32	ઠ	16	1500	96	.13370	1500
32 -	6	16	3000	187	-26045	3000
32	6	16	4500	283	.39415	4500
32	6	16	6000	378	.52646	6900
32	.6	16	7500	473	.65877	7500
32	6	16	9000	561	.78134	9000
32	6	16	10500	653	.90947	10500
32	6	16	12000	748	1.04178	12000
32	6	-16	13500	840	1.16992	13500
32	6	16	15000	933	1.29944	15000
32	6	16	-1500	-93	12953	-1500
32	6	16	-3000	-188	26184	-3000
32	6	16	-4500	-282	39276	-4500
32	6	16	-6000	-375	52228	-6000
32	6	16	-7500	-469	65320	~7500
32	6	16	-9000	-562	78273	-9000
32	6	16	-10000	-621	86490	-10000
32	6	16	-10500	-650	90529	-10500
32	6	16	-12000	-746	-1.03900	-12000
32	6	16	-13500	-836	-1.16435	
32	6	16	-15000	-931	-1.29666	-15000
INTE	RCEPT	SLOPE	1 · SL	OPE 2 S	LOPE 3	SLOPE 4
AVE.DELTA Y		MAX .+	- XAM	TTIMO	ED X	
-14	388	11535.	616			
30.687		51.491	-82.981	•0	.00000	
-1	1.894	11540.	220			
	2.7	•026	50.005	-63.597	• 6	5877
-8		11543.				
	24	.233	48.371	-51.335	• 5	2646
-!		11538.	438			
	22	.969	42.542	-48.743	-1.1	6435
+;		11534.				2
•	21	•908	37.007	-43.560	9	0529

1-10-61

13-511

investigation

## REACTION PLATFORM DRAG LOAD CALIBRATION PROCEDURE FOR ADJUSTING DRAG PRELOAD



1-Pull out rear end reller strip.

2-Sorew tension bolts to contact with frame end.

3-Pull out link 2 pin and disconnect link 2 leads from bridge.
Replace with resistors (two 500K...) of near equal values.

4-Load platform to preload value (7500 lbs.). Record bridge m.v. reading.

5-Remove load, reinsert link 2 pin (but do not hook up bridge) and tighten tension bolts to m.v. level attained in step 4. Secure lock nuts.

6-Remove the two resistors and hook link 2 back into bridge.

7-Replace rear end roller strip. Adjust platform end by spacing out as required for proper clearance (no end play).

8-Conduct regular calibration.

The purpose for preloading the two drag links is to create more accurate oscillograph readings. This is done by eliminating a back lash condition in the links which occurs when the drag load is near zero value.

FORM 28-9-1 1 3- 511 E 8 1110.

1 1

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PREPARED BY R. D. Meriwether
Time Idg. Loads Investigation

PAGE 9.024 MODEL 40036

## DESCRIPTION:

Nose gear vertical platform. This transducer not recorded after airplane drop test No. 32.

## CONSTANT:

Lbs. = 24106  $8/\Delta$  / 500 K Ohms Resistor Calib. Drops 1 - 14

Lbs. = 23950  $\delta/\Delta$  / 500 K Ohms Resistor Calib. Drops 15 - 32

## CHARACTERISITCS:

### TRANSDUCER

TYPE - DAC Design ES 5212457

SERIAL No. - 6

#### GALVAHOMETER

TYPE - 7-342

**SERIAL NO. - 7302** 

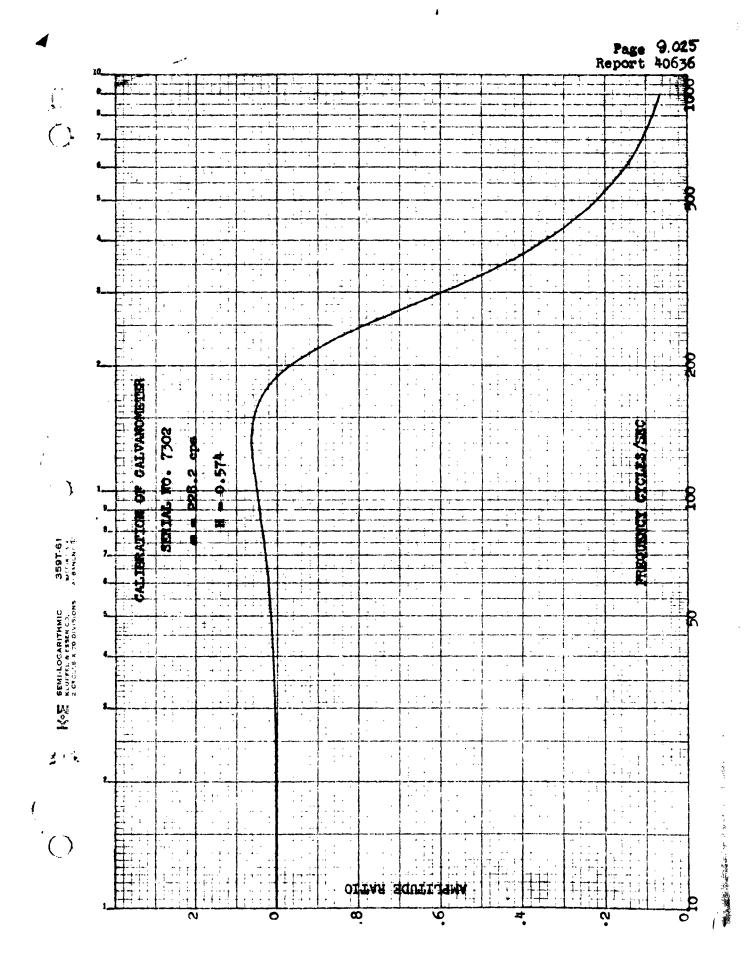
RESISTANCE - 344.6 Ohms

NATURAL FREQUENCY - 228.2 cps

DAMPING - 0.574

#### RECORDED:

Oscillegraph Channel 1-25 for Drop Test

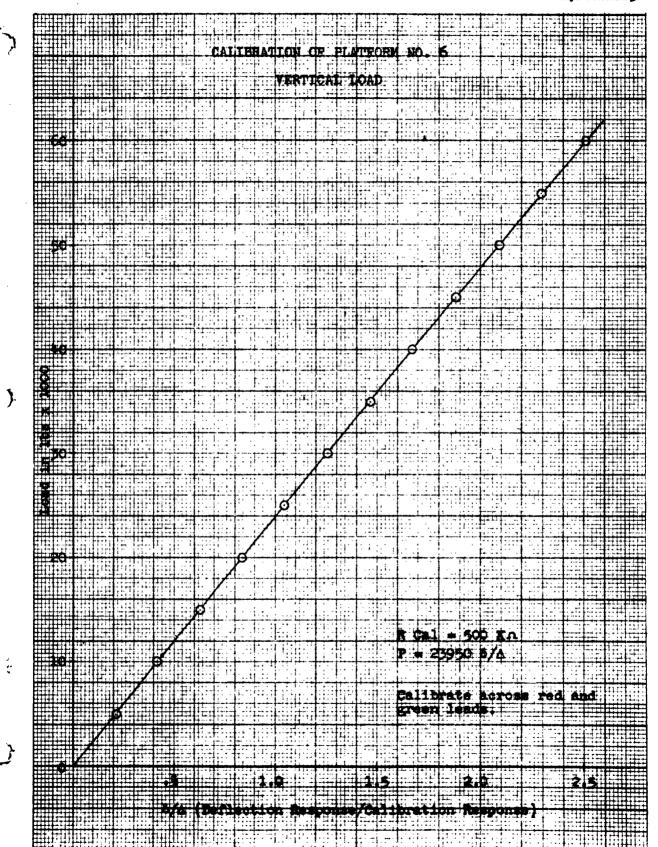


FORM 25 06 (5-51)

1. 1 2.

Analysis Ldg. Loads Investigation
Propared by H.D. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.
Date 29 Dec. 1960

Page 9,026 Model A4D-2 Report No40636



29 Dec. 1960

DOUGLAS AIRCRAFT COMPANY, INC. EL SUGUNDO DIVISION

PACE 9.027

# CALIBRATION OF PLATFORM NO. 6 VERTICAL LOAD

# P = 23,950 8/A @ 500 K

TEST	RLN	CHANNEL	LCAL	READING	٨	· <b>v</b> ,
ં	. 1	1		490		
. ć	1	1	SCCC '	103	.21020	5000
6.	1	1	10003	204	.41633	10000
8-	1	1	15000	307	. 62653	15000
£	1	1.0	20000	409	. 23467	20000
· t	1	1	25000	511	1.04286	25000
- 6	1	1	<b>30</b> 000	515	1.25510	30000
· 6	1	1	35000	717	1.46327	35000
6	1.	1	40000	319	1.67143	40000
6	1	1	45000	721	1.87959	45000
6	1	1	30000	1023	2.08776	50000
٤.	1	1	55000	1125	2.29592	55000
6	1	1	90000	1229	2.50815	60000

INT	TERCEPT AVE.CELTA				SECPE MAX	3 JEOPE OMITTED X	ı
	2.318 26.215	23936.68	١.		-45.271	ac600.	
	7.544 24.046	23935.84	:		-42.561	1.25510	
,	-2.159 20.708	23946.91	)	•	-38.643	2.50°16	
	207 16-014	23948.89	,		-33.940	1.46327	
	18.504	23738.01	i		-29.482	-21020	

144. 8

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FORM	LB25	5.	1 A
(3-5	2)		

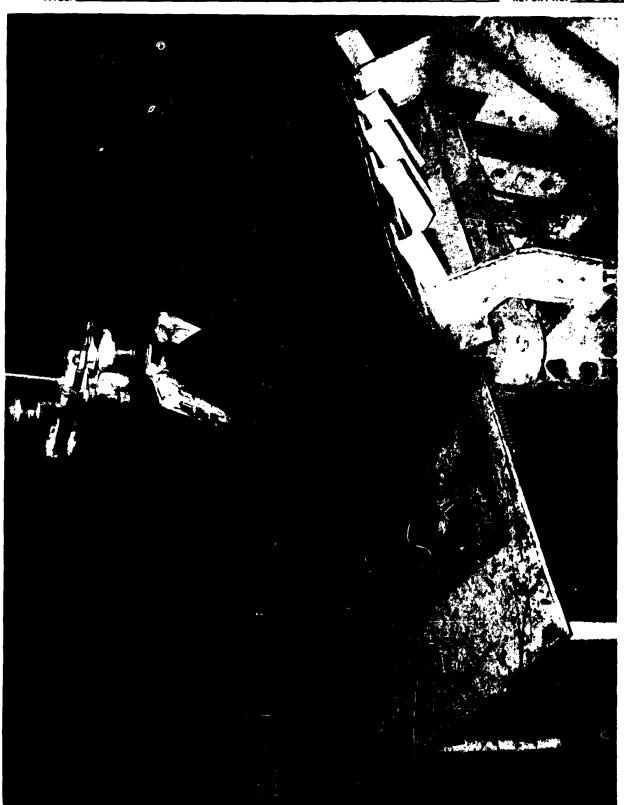
DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BY: \_\_\_

TITLE: LANDING LOADS INVESTIGATION

PAGE: 9.028 MODEL: A4D-2

REPORT NO. 40636



168

FO	RM	3	•	•	3	•
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#### DOUGLAS AIRCRAFT COMPANY. INC.

DATE		
PREPARED BY	H. D. Meriwether	
	Loads Investigation	

PAGE 9.101 MODEL 440-2 REPORT 40636

#### Wing Lift For Drop Tests

For the drop test phase of the program, an upward force was applied to the structure at the instant the free-falling airplane centacted the reaction platforms. The upward force to be applied was based on the aircraft weight and load-factor actually encountered during the flight test phase of the program. The actual loads applied by the lift devices were measured by calibrated force links. Photographs of the right-hand and left-hand wing lift link transducer installations are shown on Pages 9.107 and 9.113 respectively.

7:2

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#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY H. D. Meriwether Title Idg. Ioads Investigation

PAGE 9,102 MODEL 410-8 REPORT 40636

#### DESCRIPTION:

Right hand wing lift link. This transducer measures wing lift applied by the right hand wing lift pot to A/C stations X=50.5, Y=233.7, Z=-18.0.

#### CONSTANT:

Lbs = 5123 8/A

#### CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Design

Serial No. - 44A

#### GALVANOMETER

Type - 7-338

Serial No. - 4365

Resistance - 120.7 Ohms

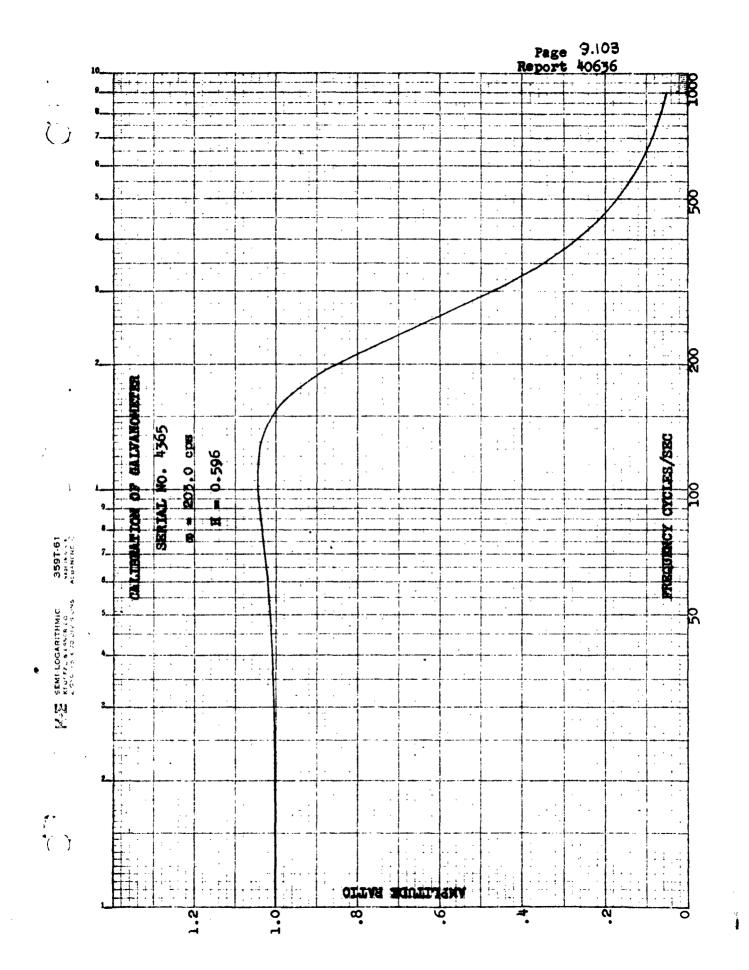
Natural Frequency - 203.0 cps

Damping - 0.596

#### RECORDED:

Oscillograph Channel 2-24 for Drop Test

376



# DOUGLAS AIRCRAFT COMPANY, INC.

DAVE 26 Dec. 1960
PREPARED BY H. D. Morivether
Title Ldg. Loads Investigation

PAGE 9.104. MODEL 449-2

#### CONDITION

#### CALIBRATION OF R.H. LIFT POT LINK NO. 44A

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT NUMBER		CHANNEL RESPONSE IN MILLIVOLTS					
		P = 51	10 5/4	A			
CHANNEL	CHANNEL TITLE						
CHANNEL	NUMBER						
GAGE TYPE	<u> </u>						
GAGE RES	ISTANCE	120					
BRIDGE T	YPE	Pul1					
GAGE FAC	TOR						
BRIDGE VO	OLTAGE	10 <b>v</b>	107	10 <b>v</b>			
CALIBRAT	CALIBRATION RESISTANCE		50K	50X			
CALIBRAT	CALIBRATION RESPONSE		6.16				
	lbs.		ino.	dec.			
ZERO	ZERO	0	0	01			
	1000	1.24	1.25	1.18			
	2000	2.40	2.44	2.37			
	3000	3.61	3.63	3.57			
	4000	4.80	4.82	4.77			
	5000	5.99	6.03	5.94			
	6000	7.17	7.25	7.17			
	7000	8.40	8.42	8.33			
	8000	9.59	9.66	9.57			
	9000	10.79	10.83	10.73			
	10000	11.99	11.98	11.98			
RETURN ZERO	RETURN ZERO	02					

( 5-51)

, ,

## CALIBRATION OF R.H. MAIN GEAR No. 16 LIFT POT LINK NO. 44A

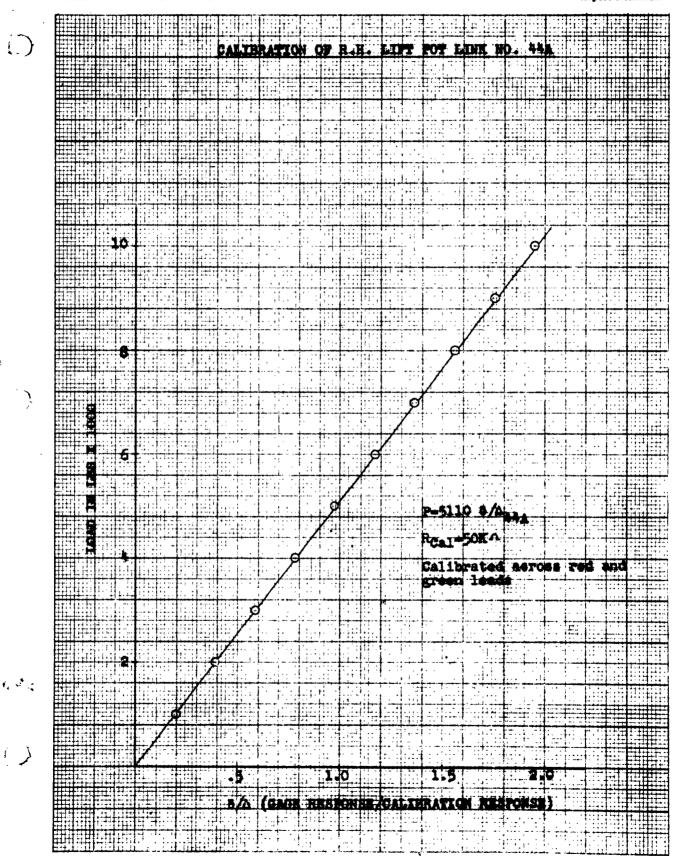
TEST	RUN	CHANNEL	LCAD	READING	X	Y
44	1	1		613		
44	1	1	1000	122	.19902	1000
44	1	1	2000	240	.39152	2000
44	1	1	3000	360	.58728	3000
44	1	1	4000	480	.78303	4000
44	j	i	5000	599	.97716	5000
44	1	1	6000	720	1.17455	6000
44	1	1	7000	832	1.36705	7000
44	1	1	8000	761	1.56770	8000
44	1	1	9000	1079	1.76020	9000
44	1	1	10000	1200	1.75759	10000
INI		SLOPE ELTA Y		OPE 2 S	LOPE 3 OMITT	
		5114. .428		-12.320	.0	0000
		5113. •588	279 9.591	-11.561	1.3	6705
		5108. •638	406 7.304	~9.406	.1	9902
		5110. .042		-4.33E	1.5	677C
	-1.558	5110. •911	991 5-214	-3.644	. 9	7716

FORM 28 86 (5-51) Analysia Ldg. Loads Invest.

Propared by H. Meriwether Douglas Aircraft Company, Inc.

Date Dec. 1960

Page 9.106 Model A4D-2 Report No40636



FORM LB25- \$- 1A (3- 52)

DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 9.107

LANDING LOADS INVESTIGATION



328

rank en en e

PREPARED BY H. D. Meriwether
Time Idg. Loads Investigation

9.108 Model A4D-2 REPORT 40636

#### DESCRIPTION:

Left hand wing lift link. This transducer measures wing lift applied by the left hand wing lift pot to A/C stations X = -50.5, Y = 233.7, Z = -18.0.

#### CONSTANT:

Lbs =  $5044 \, \delta/\Delta / 50K$  Ohms Resistor Calibration

#### CHARACTERISTICS:

#### TRANSDUCER

Type - DAC Load Link

Serial No. - 41A

#### GALVANOMETER

Type - 7-338

Serial No. - 4357

Resistance - 120.4 Ohms

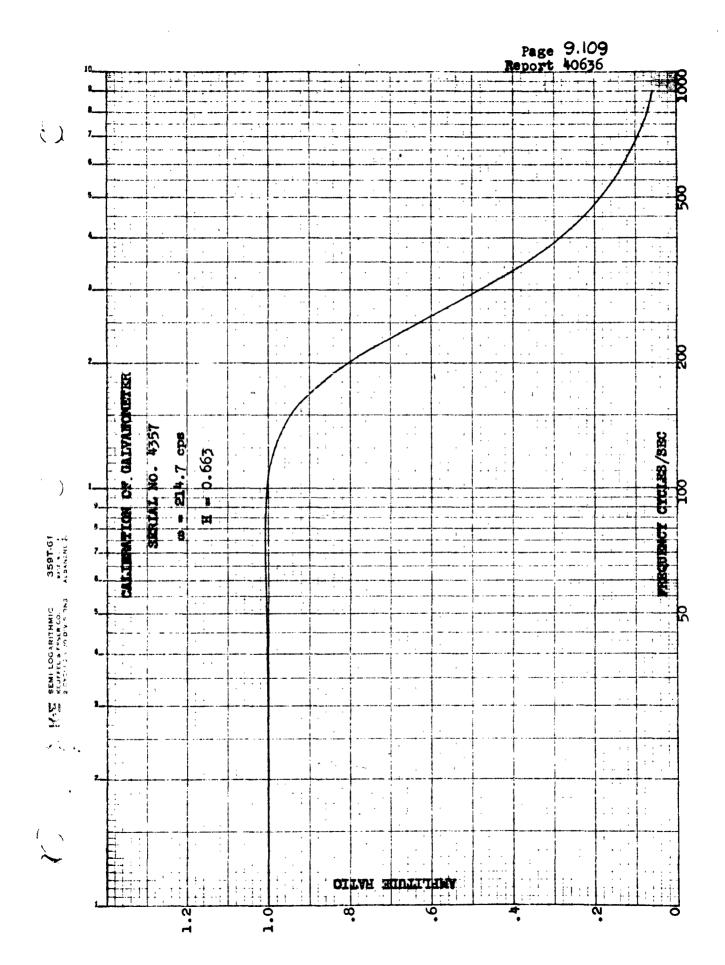
Natural Frequency - 214.7 ops

Damping - 0.663

#### RECORDED:

Oscillegraph Channel 2-23 for Drep Test

1.25



# FORM 85-9-1

#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY H. Meriwether
Title Ldg. Loads Invest.

PAGE 9.110 MODEL A4D REPORT 40636

CONDITION

#### CALIBRATION OF L.H. LIFT POT LINK NO. 41A

CALIBRATE BETWEEN RED AND GREEN LEADS

GAGE LOT	NUMBER	CHANNEL RESPONSE IN MILLIVOLTS						
	,	P = 4980 8/A41A						
CHANNEL	TITLE			•				
CHANNEL NUMBER								
GAGE TYP	Ε							
GAGE RES	ISTANCE	120						
BRIDGE T	YPE	Full						
GAGE FAC	TOR							
BRIDGE V	CLTAGE	10 <b>v</b>						
CALIBRATION RESISTANCE		50 <b>K</b>		50K				
CALIBRATION RESPONSE		6.17		6.17				
	lbs.	inc.	dec.	inc. load	dec. load			
ZERO	ZERO	0	0	0	0			
	1000	1.31	1.18	1.28	1.23			
	2000	2.53	2.42	2.53	2.44			
· · · · · · · · · · · · · · · · · · ·	3000	3.77	3.65	3.77	3.69			
	4000	4.98	4.90	4.99	4.93			
	5000	6.20	6.14	6.24	6.17			
	6000	7.44	7 <b>.3</b> 9	7.48	7.40			
	7000	8.68	8.61	8.73	8.67			
	8000	9.92	9.87	10.02	9.93			
	9000	11.17	11.07	11.22	11.12			
	10000	12.37	12.37	12.42	12.42			
RETURN ZERO	RETURN ZERO							



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DOUGLAS AIRCRAFT COMPANY, INC. EL SEGUNDO DIVISION PAGE 9.111 REPORT 40636.

## CALIBRATION OF L.H. MAIN GEAR No. 10 LEFT POT LINK NO. 41A

TEST	RUN	CHANNEL	LCAD	READING	` X	Y
41	1	1		617		
ŭ i	i	ì	1000	•	.19773	1000
41	i	1	2000	243	.40194	2000
41	ì	1	3000	372	.60292	3000
41	ì	1	4000	495	.80227	4000
41	}	1	5000	619	1.00324	5000
41	1	1	6000	743	1.20421	
4.1	1	1	7000		1.40519	7000
41	1	1	8000		1.60940	0003
41	1	1	9000	_		
4.1	1	1	10000	1239	2.00810	10000
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		.241	8.920	-12.83	.00	0000
	6.501	4976.	443			
		.032		-6.88	5 1.6	0940
	.624	4780.	506		,	
	2		3.671	~3.45	.19	9773
	750	4981.	.211			
	1	.977	3.393	~2.50	.8	0227
	-1.79R	4781.	.600			
		.535		-1.77	2 1.0	0324

FORM 45 86 (5-51)

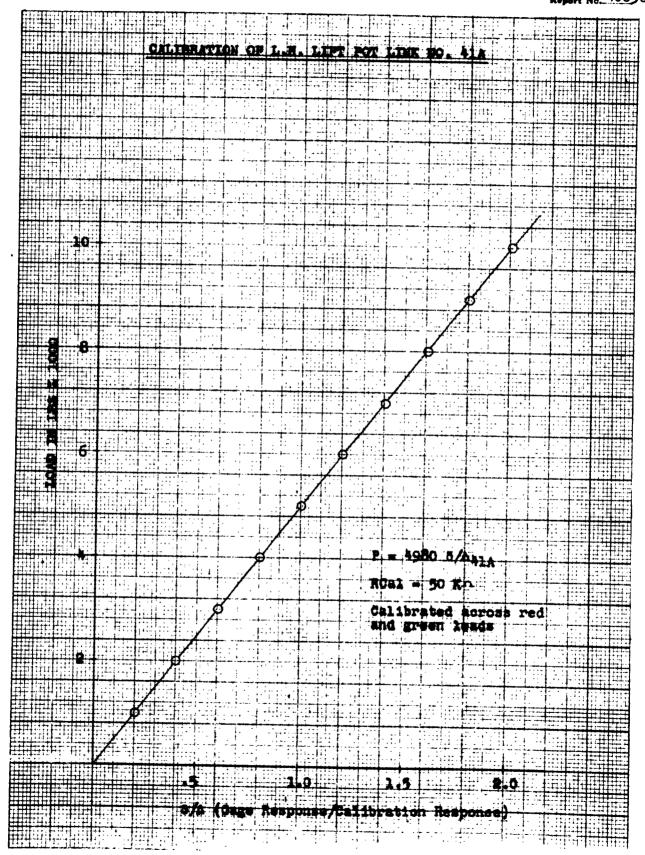
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Analysia Ldg. Loads Invest.

Propared by H. Meriwether DOUGLAS AIRCRAFT COMPANY, INC.

Date 28 Dec. 1960

Page 9.112 Model A4D Report No. 40636



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DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED E	۱¥۱	DATE
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PAGE: 9.113

LANDING LOADS INVESTIGATION



BRANSDUCER INSTALLATION

FORM	L 825.	5.	1 A
(3.5	2)		

DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BYI. LANDING LOADS INVESTIGATION REPORT NO. 40836

FORM 25-5 1

PREPARED BY H. D. Heriwather
TITLE Ldg. Loads Investigation

PAGE 9.201 MODEL 440-2 REPORT 40636

#### Drop Test Release Time

A micro-switch was installed on the drep test quick-release heek in order to record the instant of release. The details of this installation are shown on Page 9.202 and a photograph is included on Page 9.203.

#### Time Base

The time base used for all time measurements on the oscillograph records for the drop tests was furnished by a Hewlett Packard 205AG Oscillator with 1000 cycles per second recorded simultaneously on all the oscillographs.

For the flight test phase, a crystal centrolled frequency generator unit set for 50 cps was utilized with a similar setup.

#### Strain Gage Voltage Moniter

The voltage applied to the test instrumentation transducers was monitored during the tests and recorded as indicated on Page 9.205.

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644

PREPARED BY H. D. Meriwether
TITLE Idg. Loads Investigation

PAGE 9:202 MODEL A40-2 REPORT 40636

#### DESCRIPTION:

This transducer indicates the time at which the aircraft was released by the quick release hook.

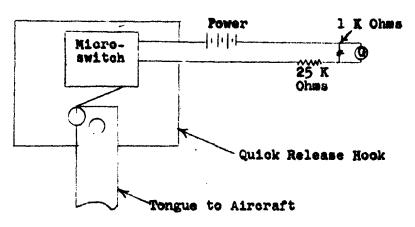
#### CHARACTERISTICS:

#### GALVANOMETER

Type - 7-323

Serial No. - 8235

Resistance - 1 K Ohms



#### RECORDED:

Oscillograph Channel 2-1 for Drop Test

DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY R. D. Heriwether
TITLE Life. Leads Investigation

PAGE 3.204 MODEL 145-3 REPORT 456-36

#### DESCRIPTION:

Timing Clock. This transducer records time on the oscillegraph record.

#### CONSTANT:

1000 Pips/Second

#### CHARACTERISTICS:

#### TRANSDUCER

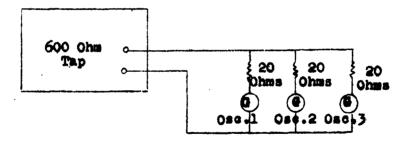
Type - Hewlett Packard 205. AG Oscillator

#### GALVANOMETER

Type - 7-326

Serial No. - 5225 (Oscillograph 1)

Serial No. - 7078 (Oscillograph 2)



#### RECORDED:

Oscillograph Channels 1-18 and 2-20 for Drop Test

368

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#### DOUGLAS AIRCRAFT COMPANY, INC.

PREPARED BY Ka Do Heriwather
TIVLE Idea Lands Investigation

PAGE 9:205

#### DESCRIPTION:

Strain gage voltage monitor.

#### CONSTANT:

None - measures relative voltage.

#### CHARACTER ISTICS:

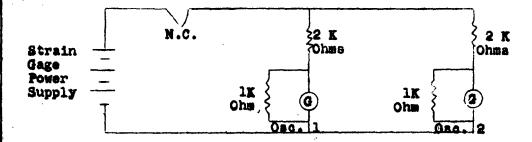
#### GALVANOMETER

Type - 7-323

Serial No. - 8548 (Secillegraph No. 1)

Serial No. - 8072 (

(Oscillograph No. 2)



#### RECORDED:

Oscillograph Channels 1-22 and 2-22 for Drop Test

FORM 25-5 1

PREPARED BY H. D. Mariwather
TITLE Idg. Loads Investigation

PAGE 9.206 MODEL A4D-2 REPORT 40636

#### TRODI

A TRODI unit, on loan from NATC, was utilized during the drop test program to define the vertical velocity of the airplane just prior to contact with the reaction platforms. The mirror units which were installed on the landing gear during the flight test phase were also utilized for the drop test phase. A stand was fabricated to position the TRODI unit properly to record the vertical velocity just above the reaction platform. The TRODI equipment was calibrated by the use of a free-fall jig fabricated for the purpose.

12.89 -

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PORM 25-9-1
C 511
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PREPARED BY I. E. Harris
Title Ldg. Leads Investigation

PAGE 10.001 MODEL 440-2 REPORT 40636

#### OSCILLOGRAPH SCHEDULES

The oscillograph schedules used during the flight test phase and during the drep test phase of the program are included en Pages 10.002 through 10.021. These schedules list the oscillograph channels used for recording the test parameters together with the pertinent information concerning the transducers, the central panels, and the galvanometers.

HE

FORM LB25-5-1A

PREPARED BY: I. R. Happis DOUGLAS AIRCRAFT COMPANY, INC.

10.002

A4D-2

TITLE: Landing Leads Investigation

REPORT NO. \_40636

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FORM L825 5 1A

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PREPARED BY: 1.8. Happis DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 10.003

TITLE: Landing Loads Investigation

REPORT NO. 40636

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FORM LB25 5 1A

PREPARED BY: I. H. Harris DOUGLAS AIRCRAFT COMPANY, INC.

CHECKED BY: DATE

TITLE: Landing Loads Investigation REPORT NO. 40636

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FORM LB25 5 1A

PREPARED BY: I. E. Harris DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 10.005

TITLE: Landing Loads Investigation

REPORT NO. 40636

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FORM 1825 5 1A (3.52)

PREPARED BY: I. E. Harris DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 10.006

TITLE: Landing Loads Investigation

REPORT NO. 40636

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PREPARED BY: I. E. HATTIS DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 10.007

REPORT NO. 40636

TITLE: Landing Loads Investigation

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FORM CB25 S 1A

PREPARED BY: I. R. Happis DOUGLAS AIRCRAFT COMPANY, INC.

PAGE: 10.008

TITLE: Landing Loads Investigation

REPORT NO. 40636

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FORM LB25 5 1A

PREPARED BY: I. B. Harpis DOUGLAS AIRCRAFT COMPANY, INC.

AGE: 10.009

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TITLE: Landing Loads Investigation

REPORT NO. 40636

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FORM L B25-5 1A

PREPARED BY: I. E. Harris DOUGLAS AIRCRAFT COMPANY, INC.

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CHECKED BY: TITLE: Landing Loads Investigation

REPORT NO. 40636

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TITLE: Lawing Loads Investigation REPORT NO. 40636

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FORM LB25-5 1A OUGLAS AIRCRAFT COMPANY, INC. 11 52) PREPARED BY: M. MOTAN Landing Ū ACTOR SEQUESTION OF CONTROL OF CO 9 8 17:17 2 2 2 2 2 2 2 2 2 2 ; 38 11 \$ E

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PREPARED BY H. D. Hardwelther DOUGLAS AIRCRAFT COMPANY, INC.

TITLE: Landing Loads Investigation

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FORM LB25- 5- 14 GLAS AIRCRAFT COMPANY, INC. (3-52) O TOTAL OF THE PROPERTY OF THE P The Property on the Article of Strategies and Article of Strategies an TO BE PARALLELED TO CHANNEL 20 OF ODCILLORANS & AND CHANNEL 2 OF OSCILLORANS WO. 3 TO BE PARALLELED TO CO DECILIMENTS NO. 2" 488 OSCILLIDEANNE NO. 3 TO BE PARALLELED TO DECILLEMENT WE. Z TO BE PARALLELED TO DECEL TOWNS AND 2 STRATE CASE - NA 975 17 12 29 ٠, ف ALA & M P 21 M P 2 M B M B M B M M 1, OSCILL BORREY 3.0% ¥ 35.8 3-1 SW-1 POI ( IN. 3-1) POI ( IN. 3-1) 35 1 CORC 77.76 PARE L SPEDIL MECHANICAL 2070 POSITION COMMISSION OF THE COMMISSION O CABLE ž 2 Competed St. 22 - 17 with East Water Cife of PatristD - Deby RO, 34 and Bibbs Odd PO5 17 1045 92. 0.00 (10 m) 10 d. 10 5 25. 17. 5 17.11 : 10-10 - 20- 10 (m.P.) 3 35-31-34 (1) 35-31 DAG SAL Ě 04-06-14 6.3 OF 2 AND THE STATE OF T CONTRACTOR STRUCTURE (SECURE OF SECU A Res person and vibility aft. F. PHO. ATLINE D. C. 1

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PREPARED BY: E. D. Marriagethan DOUGLAS AIRCRAFT COMPANY, INC.

TITLE: Landing Lands Investigation

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